

APPENDIX B1

PROJECT SPECIAL PROVISIONS

I-405, SR520 to SR522 Stage 1 (Kirkland Stage 1)

Final Package Review – 15%
January 25, 2005



Project Team

Congestion Relief & Bus Rapid Transit Projects

APPENDIX B1 – PROJECT SPECIAL PROVISIONS

TABLE OF CONTENTS

INTRODUCTION.....	1
DIVISION 2 EARTHWORK.....	3
 DIVISION 3, PRODUCTION FROM QUARRY AND PIT SITES AND STOCKPILING.....	15
DIVISION 4, BASES	19
DIVISION 5, SURFACE TREATMENTS AND PAVEMENTS	21
DIVISION 6, STRUCTURES	25
GENERAL REQUIREMENTS FOR STRUCTURES.....	25
 DIVISION 7 - DRAINAGE STRUCTURES, STORM SEWERS, SANITARY SEWERS, WATER MAINS, AND CONDUITS.....	129
DIVISION 8 - MISCELLANEOUS CONSTRUCTION	131
DIVISION 9 - MATERIALS.....	157
STANDARD PLANS	171

APPENDIX B1 – PROJECT SPECIAL PROVISIONS

INTRODUCTION

The following Special Provisions are made a part of this contract and supersede any conflicting provisions of the 2004 Standard Specifications for Road, Bridge and Municipal Construction, and the Amendments to the Standard Specifications found in Appendix B2. The provisions of Chapter 2, Technical Specifications, of the RFP shall supersede any conflicting provisions found in these Project Special Provisions.

Wherever the term “Contractor” is used it shall mean the “Design-Builder”.

DIVISION 2 EARTHWORK

2-01, CLEARING, GRUBBING, AND ROADSIDE CLEANUP

Clearing and grubbing on this project shall be performed within the following limits:

Construction Requirements

Roadside Cleanup

Section 2-01.3(4) is supplemented with the following:

2-02, REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Description

Section 2-02.1 is supplemented with the following:

This work shall consist of removing miscellaneous traffic items

The Design-Builder is advised that asbestos may be present on this project.

Construction Requirements

Section 2-02.3 is supplemented with the following:

Removal of Obstructions

Removing Miscellaneous Traffic Items

The following miscellaneous traffic items shall be removed and disposed of:

Removal of Bridges, Box Culverts, and other Drainage Structures

Section 2-02.3(2) is supplemented with the following:

Plans of the existing bridge(s) are available at the Project Engineer's Office for the prospective bidder's inspection.

Bridge Demolition Plan

The Design-Builder shall submit a bridge demolition plan with working drawings and calculations to WSDOT for approval in accordance with Section 6-01.9, showing the method of removing the existing bridge(s), or portions of bridges, as specified.

The bridge demolition plan shall show support bents, bracing, guys, lifting devices, lifting attachments, the sequence of demolition and removal, the type of equipment to be used in all demolition and removal operations, the location of cranes and barges, the location of support or lifting points, and the weights of structure parts being removed. The plan shall include a crane stability analysis and crane load calculations based on the controlling crane picks of the Design-Builder's plan. The plan shall detail the containment, collection, and disposal of all debris. The plan shall show all stages of demolition.

The Design-Builder shall not begin removal operations until receiving WSDOT's **approval** of the bridge demolition plan.

Use of Explosives

Explosives shall not be used in the demolition.

Requirements for Closing Bridge to Traffic Prior to Beginning Removal

The Design-Builder shall not close portions of the existing bridge to traffic, and shall not begin bridge removal operations, until the following conditions are met:

1. The Design-Builder has submitted the bridge demolition plan to WSDOT.
2. The Design-Builder has sufficient material on hand to complete bridge removal and bridge construction operations in the least possible time.
3. The Design-Builder shall furnish a report on the status of material delivery to WSDOT. The report shall specify the materials already available at the site, the materials yet to arrive at the site, and the scheduled delivery dates of the materials yet to arrive at the site.

The Design-Builder has received WSDOT's approval to proceed.

Removal of Pavement, Sidewalks, and Curbs

Section 2-02.3(3) is supplemented with the following:

The approximate thickness of the *** \$1\$\$ *** pavement is *** \$2\$\$ ***.

2-03, ROADWAY EXCAVATION AND EMBANKMENT

Description

Section 2-03.1 is supplemented with the following:

This work shall also consist of excavating and grading for the construction of wetland mitigation sites, including hauling and disposing of all unwanted excavated material from within the project limits.

This work shall include installing a clay liner at the wetland mitigation site to reduce soil permeability by incorporation of imported bentonite into the native base soil.

Section 2-03 is supplemented with the following new section.

2-03.2 Materials

Section 2-03.2 is supplemented with the following:

Bentonite for Clay Liner

Bentonite shall be a free-flowing, semigranular, high swelling, sodium montmorillonite clay (bentonite) without additives. Calcium bentonites and chemically treated calcium bentonites will not be approved.

Bentonite shall be supplied by one of the following:

1. Bentonite Corp., Denver, CO, 303-296-5652
2. Federal Ore and Chemicals Co., Houston, TX, 713-308-9634
3. WYO-BEN Inc., Billings, MT, 800-548-7055
4. or approved equal meeting the following requirements:

Bentonite shall have the following index properties:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

1. Bentonite shall be high swelling. High swelling is defined as the ability of 2 grams of the base bentonite, when mechanically reduced to minus 100 mesh, to swell in water to an apparent volume of 16 cc or more when added gradually to 100 cc of distilled water contained in a graduated cylinder. The natural moisture content shall not exceed 12 percent.
2. Dry fineness of the bentonite shall be 100 percent passing the No. 10 U.S. sieve.

Index properties of the bentonite shall be measured by a certified independent laboratory. Each sample shall be accompanied by a manufacturer's Certificate of Compliance and the lab test report.

Construction Requirements

Embankment Construction

Compacting Earth Embankments

Section 2-03.3(14)C is supplemented with the following:

If a clay liner is specified to be placed on top of an embankment, the top 2 feet of each embankment shall be the top 2 feet immediately underneath the clay liner.

If special soil mix is specified to be placed on top of an embankment, the top 2 feet of each embankment shall be the top 2 feet immediately underneath the special soil mix.

Section 2-03.3 is supplemented with the following:

Wetland Mitigation Site Excavation Including Haul

The Contractor shall submit to the Engineer a proposed schedule for the wetland mitigation site excavation and finish grading a minimum of 7 calendar days prior to commencing wetland mitigation site excavation and grading.

The schedule shall indicate:

1. The proposed start and finish times for mitigation site excavation and grading activities.
2. The proposed time for inspection by a multi-disciplinary team representing the WSDOT region environmental coordinator, region biologist, and region landscape architect.

This inspection shall be scheduled to occur when the Contractor has completed initial excavation and grading shown in the Plans, and before equipment has been removed from the site.

The Contractor shall request that the Engineer schedule the multi-disciplinary team inspection.

The Contractor shall allow 3 working days to complete the inspection after initial grading has been completed. The multi-disciplinary team will review the grades and assist in evaluating whether the grades are in conformance with the contours and spot elevations shown in the Plans.

Following inspection by the multi-disciplinary team, the Contractor shall adjust grades as necessary to be in conformance with the contours and spot elevations as shown in the Plans.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

All excavated materials shall become the property of the Contractor and shall be disposed of off the project site in accordance with Section 2-03.3(7)C.

Clay Liner

The clay liner shall be created by the incorporation of bentonite into the surface of the base soil. The Contractor shall prepare the area by loosening and breaking up the surface of the entire base soil by ripping, blading, rotovating, or other means to achieve a minimum loosened soil depth of 8 inches. The Contractor shall grade the soil to obtain a relatively smooth surface and aerate as required to achieve a relatively dry workable soil surface.

Following excavation and grading of the site to base soil level, the Contractor shall overexcavate any organic materials to a depth of 8 inches below the base soil level. Overexcavated areas shall be filled to the base soil level with non-organic native soil.

The Contractor shall submit for approval a proposal for the method of incorporation of the bentonite into the base soil. Prior to approval, the Contractor shall demonstrate the proposed method of incorporation in a test area and show that the method is capable of incorporation to a depth of 8 inches. To provide data to the Engineer for calculation of bentonite quantities, the Engineer will also evaluate the effective depth of thorough and uniform incorporation attainable using the proposed method. The Engineer will then calculate the amount of bentonite required.

The Contractor shall allow two weeks for evaluation and calculation of bentonite quantities by the Engineer.

The Contractor shall spread the required quantity of bentonite over the base soil, using mechanical means to provide uniform coverage. After the bentonite has been spread, the Contractor shall incorporate the bentonite into the base soil to a minimum depth of 6 to 8 inches. Incorporation shall be accomplished using the approved method to obtain a uniform blend of materials, free from lumps or pockets of unmixed materials.

Following incorporation of the bentonite, the Contractor shall compact the clay liner. Compaction shall be accomplished with a minimum 10,000 pound static drum roller, or other method.

The compacted surface shall be protected from damage due to drying and cracking and from excess water, until special soil mix has been placed over the liner and vegetation has been planted. The Contractor shall repair all cracks and other damage to the clay liner by replacing excessively wet material, remixing and compacting cracked material, and other measures required to restore the material to the satisfaction of the Engineer.

Landscape Grading

The Contractor shall perform additional finish grading of the surface of existing soil within the project limits. This work includes contouring the ground surface to establish positive drainage and finish grades for site development in accordance with Section 8-02.3(4).

2-09, STRUCTURE EXCAVATION

Construction Requirements

Removal of Unstable Base Material

Section 2-09.3(1)C is supplemented with the following:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

If unsatisfactory foundation material, as determined by WSDOT, is encountered for placing bridge footings, the foundation material shall be excavated below the footing, and the unsatisfactory material replaced with gravel backfill for foundation Class A, or lean concrete, except, when the maximum design soil pressure is greater than five tons per square foot, lean concrete only shall be used for replacing the unsatisfactory material.

Lean concrete is defined as an approved aggregate and cement mixture which possesses a minimum compressive strength of 2,000 pounds per square inch at 28 days.

The unsatisfactory material shall be removed to a maximum of 3 feet below the bottom of the footing elevation, unless WSDOT directs the Design-Builder to excavate deeper. Excavations greater than 3 feet below the bottom of the footing may require redesign of the footings and columns.

Shoring And Cofferdams

Section 2-09.3(3)D is supplemented with the following:

The Design-Builder shall protect the existing pavement from damage due to the Design-Builder's operations and shall shore all excavation adjacent to the existing pavement.

The Design-Builder shall protect the existing track and facilities of the Railroad Company from damage due to the Design-Builder's operations, and shall shore all excavation adjacent to the existing railroad track. Shoring shall be steel sheet piling designed for a Cooper E-80 loading according to the A.R.E.A. Manual For Railway Engineering. Damage to the railroad track or railroad facilities, due to the Design-Builder's operations, will be repaired by the Railroad at the Design-Builder's expense.

2-12, CONSTRUCTION GEOTEXTILE

Description

Section 2-12.1 is supplemented with the following:

Geosynthetic Reinforced Slope

The Design-Builder shall furnish and construct geosynthetic reinforced slopes in accordance with the details shown in the Plans, these specifications, or as directed by WSDOT.

Materials

Borrow

Section 9-03.14 is supplemented with the following:

Geosynthetic Properties For Retaining Walls and Reinforced Slopes

Section 9-33.2(2) is supplemented with the following:

Geosynthetic Properties for Reinforced Slopes

Geotextile reinforcement (primary and secondary) in geosynthetic reinforced slopes shall conform to the properties specified in Tables 7 and 11.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

If geogrid reinforcement is used for wrapped face reinforced slope construction, the geotextile material placed at the wall face to retain the backfill material as shown in the Plans shall conform to the properties of Table 7.

Wide strip geosynthetic strengths are minimum average roll values (i.e., the average test results for any sampled roll in a lot shall meet or exceed the values shown in the table). These wide strip strength requirements apply only in the geosynthetic direction perpendicular to the slope face. Wide width tensile strength testing is in conformance with the most recently approved ASTM geosynthetic test procedure (ASTM D4595 for geotextiles, and ASTM D6637 for geogrids), except for geosynthetic sampling and specimen conditioning, which are in accordance with WSDOT Test Methods 914 and 915, respectively.

Table 11: Long-term tensile strength, T_{al} , required for geosynthetic reinforcement used in geosynthetic reinforced slopes.

³ Slope Location	Vertical Spacing of Primary Reinforcement Layers	Primary Reinforcement Layer Distance from Top of Reinforced slope	^{1,2} Minimum Long-Term Tensile Strength, T_{al} , for Primary Reinforcement	¹ Minimum Ultimate Tensile Strength (ASTM D4595 or D6637) for Secondary Reinforcement
\$1\$	***\$2\$***	***\$3\$***	***\$4\$***	115 lbs/in.

¹These long-term tensile strength requirements apply only in the geosynthetic direction perpendicular to the slope face.

² T_{al} shall be determined in accordance with WSDOT Standard Practice T925.

³Reinforced slopes ***\$5\$*** are classified as Class ***\$6\$*** structures.

Geosynthetic Properties for Turf Reinforcement Mat

The turf reinforcement mat shall be a three-dimensional non-degradable polymer mat conforming to the properties indicated in Table 12. All geosynthetic properties are minimum average roll values. The average test results for any sampled roll in a lot shall meet or exceed the values shown in the table.

Table 12: Turf Reinforcement Mat Property Requirements.

Property	Test Method	Minimum Property Requirements
Tensile Strength, Minimum in Machine and X-Machine direction	ASTM D5035	10 lbs/in.

Thickness	ASTM D5199 @ 0.3 psi	0.5 inch
UV Resistance	ASTM D4355 @ 500 hours	70%

Source Approval

Section 9-33.4(1) is supplemented with the following:

Geosynthetic Reinforced Slope Primary Reinforcement

Geosynthetic products which are qualified for use in geosynthetic reinforced structures for primary reinforcement (Classes 1, 2, or both) are listed in the current Qualified Products List (QPL).

For geosynthetic products proposed for use as primary reinforcement which are not listed in the current QPL, the Design-Builder shall submit test information and the calculations used in the determination of T_{al} performed in accordance with WSDOT Test Method 925 to the Olympia Service Center Materials Laboratory in Tumwater for evaluation. The Contracting Agency will require up to 30 calendar days after receipt of the information to complete the evaluation.

Source approval for reinforced slope primary reinforcement geosynthetic materials listed in the current QPL, or as approved based on data developed and submitted in accordance with WSDOT Test Method 925, will be based on conformance to the applicable values in Tables 7 and 11.

Geosynthetic Reinforced Slope Secondary Reinforcement

The Design-Builder shall submit to WSDOT the following information regarding the geosynthetic secondary reinforcement product(s) proposed for use:

- Manufacturer's name and current address,
- Full product name,
- Geosynthetic structure, including fiber/yarn type, and
- Geosynthetic polymer type(s).

If the geosynthetic source has not been previously evaluated or included in the QPL, a sample of each proposed geosynthetic shall be submitted to the Olympia Service Center Materials Laboratory in Tumwater for evaluation. A maximum of 14 calendar days will be required for this testing once the samples and required product information arrive at the Materials Laboratory. Source approval will be based on conformance to the applicable values in Tables 7 and 11. Source approval will not be the basis of acceptance of specific lots of material unless the lot sampled can be clearly identified, and the number of samples tested and approved meet the requirements of WSDOT Test Method 914.

Geosynthetic Reinforced Slope Turf Reinforcement Mat

Approval of source for turf reinforcement mat will be by Manufacturer's Certificate of Compliance.

Acceptance Samples

Section 9-33.4(3) is supplemented with the following:

Geosynthetic Reinforced Slope Primary Reinforcement

Geotextile acceptance testing shall meet the requirements of Table 7, and both geotextile and geogrid acceptance testing shall meet the required ultimate tensile strength Tult as provided in the QPL for the selected product(s). If the selected product(s) are not listed in the current QPL, the result of the testing for Tult must be greater than or equal to Tult as determined from the product data submitted and approved by the Olympia Service Center Materials Laboratory during source approval. If the results of the testing show that the reinforced slope primary geosynthetic reinforcement lot does not meet the specified properties, the roll or rolls which were sampled will be rejected, and additional sampling and testing will be performed as specified.

Geosynthetic Reinforced Slope Secondary Reinforcement

If the results of the testing show that the reinforced slope secondary reinforcement geosynthetic lot does not meet the properties specified in Table 7 (geotextiles only) and Table 11 (geotextiles and geogrids), the roll or rolls which were sampled will be rejected, and additional sampling and testing will be performed as specified.

Geosynthetic Reinforced Slope Turf Reinforcement Mat

Acceptance by Certificate of Compliance

Section 9-33.4(4) is supplemented with the following:

Reinforced Slope

The Design-Builder shall provide a Manufacturer's Certificate of Compliance to WSDOT, including polymer type in addition to all information as specified, for all quantities of reinforced slope geosynthetic material, including primary and secondary reinforcement materials, and erosion mat material when specified in the Plans.

Construction Requirements

Section 2-12.3 is supplemented with the following:

Geosynthetic Reinforced Slope Construction Requirements

Submittals

The Design-Builder shall submit to WSDOT, a minimum of 14 calendar days prior to beginning construction of each reinforced slope, detailed plans for each reinforced slope and as a minimum, the submittals shall include the following:

1. Detailed reinforced slope plans showing the actual lengths proposed for the geosynthetic reinforcing layers and the locations of each geosynthetic product proposed for use in each of the geosynthetic reinforcing layers.
2. The Design-Builder's proposed reinforced slope construction method, including any proposed forming systems, types of equipment to be used and proposed erection sequence.
3. Manufacturer's Certificate of Compliance, samples of the reinforced slope geosynthetic(s) and sewn seams for the purpose of acceptance as specified.

4. Details of geosynthetic reinforced slope corner construction, including details of the positive connection between the slope sections on both sides of the corner.
5. Details of terminating a top layer of reinforced slope geosynthetic and backfill due to a changing reinforced slope profile.

Approval of the Design-Builder's proposed reinforced slope construction details and methods shall not relieve the Design-Builder of their responsibility to construct the reinforced slopes in accordance with the requirements of these Specifications.

Reinforced Slope Construction

The Design-Builder shall excavate for the reinforced slope in accordance with Section 2-09, and conforming to the limits and construction stages shown in the Plans.

The Design-Builder shall direct all surface runoff from adjacent areas away from the reinforced slope construction site.

The Design-Builder shall begin reinforced slope construction at the lowest portion of the excavation and shall place each layer horizontally as shown in the Plans. The Design-Builder shall complete each layer entirely before beginning the next layer.

Geotextile splices shall consist of a sewn seam or a minimum 1 ft overlap. Geogrid splices shall consist of adjacent geogrid strips butted together and fastened using hog rings, or other methods approved by WSDOT, in such a manner to prevent the splices from separating during geogrid installation and backfilling. The Design-Builder shall offset geosynthetic splices in one layer from those in the other layers such that the splices shall not line up vertically. Splices parallel to the slope face will not be allowed, as shown in the Plans.

Primary reinforcing geosynthetic shall be cut to the length shown in the Plans. For geogrids, the end of the primary reinforcing located at the face of the slope shall be cut so that the cut ribs extend no more than 0.6 inch but not less than 0.2 inch from the cross ribs. For geogrids, the length of the reinforcement required as shown in the Plans shall be defined as the distance between the geosynthetic facing and the last geogrid node at the end of the reinforcement in the slope backfill.

The Design-Builder shall stretch out the geosynthetic in the direction perpendicular to the slope face to ensure that no slack or wrinkles exist in the geosynthetic prior to backfilling. Soil piles or the geosynthetic manufacturer's recommended method shall be used to hold the geosynthetic in place until the specified cover material is placed.

The Design-Builder shall place fill material on the geosynthetic in lifts such that 6 inches minimum of fill material is between the vehicle or equipment tires or tracks and the geosynthetic at all times. The Design-Builder shall remove all particles within the backfill material greater than 3 inches in size. Turning of vehicles on the first lift above the geosynthetic will not be permitted. The Design-Builder shall not end dump fill material directly on the geosynthetic without the prior approval of WSDOT.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Should the geosynthetic be damaged or the splices disturbed, the backfill around the damaged or displaced area shall be removed and the damaged strip of geosynthetic replaced by the Design-Builder at no expense to the Contracting Agency.

The Design-Builder shall place and compact the reinforced slope backfill in accordance with the reinforced slope construction sequence detailed in the Plans. The minimum compacted backfill lift thickness of the first lift above each geosynthetic layer shall be 6 inches. The maximum compacted lift thickness anywhere within the reinforced slope shall be 10 inches.

The Design-Builder shall compact each layer to 95 percent of maximum density. The water content of the reinforced slope backfill shall not exceed the optimum water content by more than 3 percent. The Design-Builder shall not use sheepsfoot rollers or rollers with protrusions. Rollers which weigh more than 6,000 lbs shall be used with the vibrator turned off. The Design-Builder may use rollers which weigh 6,000 lbs or less with the vibrator turned on with the prior approval of WSDOT.

The Design-Builder shall construct slope corners at the locations shown in the Plans, and in accordance with the reinforced slope corner construction sequence and method submitted by the Design-Builder and approved by WSDOT. Slope angle points with an interior angle of less than 150 degrees shall be considered to be a corner. The slope corner shall provide a positive connection between the sections of the reinforced slope on each side of the corner such that the slope backfill material cannot spill out through the corner at any time during the design life of the reinforced slope. The Design-Builder shall construct the slope corner such that the reinforced slope sections on both sides of the corner attain the full geosynthetic layer embedment lengths shown in the Plans.

Where required by reinforced slope profile grade, the Design-Builder shall terminate top layers of reinforced slope geosynthetic and backfill in accordance with the method submitted by the Design-Builder and approved by WSDOT. The end of each layer at the top of the slope shall be constructed in a manner which prevents slope backfill material from spilling out the face of the slope throughout the life of the reinforced slope. If the profile of the top of the slope changes at a rate of 1V:1H or steeper, this change in top of slope profile shall be considered to be a corner.

Tolerances

The Design-Builder shall complete the base of the reinforced slope excavation to within plus or minus 3 inches of the staked elevations unless otherwise directed by WSDOT. The Design-Builder shall place the external slope dimensions to within plus or minus 2 inches of that staked on the ground. The Design-Builder shall space the reinforcement layers vertically to within plus or minus 1 inch of that shown in the Plans.

The completed reinforced slope(s) shall meet the following tolerances:

	<u>Tolerance</u>
Deviation from the design slope and horizontal alignment for the slope face, when measured along a 10-foot straight	5 inches

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
edge at the midpoint of each reinforced
slope layer, shall not exceed:

Deviation from the overall design slope 3 inches
per 10 feet of reinforced slope height shall
not exceed:

Turf Reinforced Mat Facing Construction

Secondary reinforcing geosynthetic splices transverse to the slope shall be butted together and the splice shall be held together with hog rings, or other methods approved by WSDOT in a manner that will prevent the splice from separating during geosynthetic installation and backfilling.

The face of the reinforced slope shall be cleared of all rocks, dirt clods, vegetation, trash and other obstructions that may cause the mat to bridge the ground surface. The mat shall be unrolled in the direction of water flow with the flat side against the ground. The turf reinforcement mat shall be anchored at the shoulder of the slope in an anchor trench a minimum of 12 inches deep and 6 inches wide as shown in the Plans. The anchor trench shall be excavated prior to placing the erosion mat on the slope. Heavy duty steel pins or polyethylene pegs shall be used to anchor the mat to the slope face as shown in the Plans. Steel pins shall be 0.2 inch diameter minimum with a 1.5 inch diameter steel washer secured at the head of the pin. Polyethylene pegs shall be “T” type or have a 1.5 inch diameter washer secured at the head of the peg. All pins or pegs shall be 12 inches long minimum. Hog rings, or other methods approved by WSDOT, shall be used to attach the turf reinforcement mat to the cross ribs of the primary reinforcing at the face of the slope. The ties shall be as durable and strong as the material to which they are tied. The turf reinforcement mat shall be securely attached to the cross ribs by tie(s) centered between the pins or pegs.

Upon completion of the mat installation, 1 inch of Topsoil Type B, thoroughly mixed with 16-16-16 fertilizer and lime, shall be spread over the turf reinforcement mat by drop spreader, cyclone spreader, or by shovels, rakes, and brooms. The Topsoil shall be lightly raked or brushed into the mat apertures to completely fill the mat thickness. The slope shall be seeded with grass seed by broadcast or hydroseeding in accordance with Sections 8-01 and 9-14, at a rate of 0.2 oz./yd². Lime shall be applied at a rate of 30 lbs/yd³, and fertilizer at a rate of 3.7 lbs/yd³.

Geosynthetic Wrapped Slope Facing Construction

The Design-Builder shall use a temporary form system to minimize sagging of the geosynthetic facing elements during construction. A typical example of a temporary form system and sequence of reinforced slope construction required when using this form are detailed in the Plans.

Geosynthetic reinforcement splices exposed at the slope face shall prevent loss of backfill material through the face. The splicing material exposed at the slope face shall be as durable and strong as the material to which the splices are tied.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

The Design-Builder shall compact the zone within 3 ft of the slope face without causing damage or distortion to the slope face or reinforcing layers by using light mechanical tampers approved by WSDOT.

The wall face shall be stepped vertically rather than using a battered forming system. Boston Ivy shall be placed in the slope face through the geosynthetic reinforcement layers in the horizontal portion of each step as indicated in the Plans. The first row of ivy plants shall be placed in the bottom layer of the reinforced slope. Rows of plants shall be spaced vertically no more than 16 ft apart. Plants within a row shall be spaced horizontally 6 to 7 ft apart. Holes placed through the reinforcement shall be the minimum size necessary to install the plants.

Welded Wire Facing Construction

The Design-Builder shall install welded wire facing as shown in the Plans. Horizontally adjacent facing panels shall be butted together such that no gap between facing panels exists. Butted together facing panel splices shall be offset from each other in adjacent layers so that the splices do not line up with one another from layer to layer.

If secondary geosynthetic reinforcement is specified, secondary reinforcement splices transverse to the slope shall be butted together and the splice shall be held together with hog rings, or other methods approved by WSDOT in the manner that will prevent the splice from separating during geosynthetic installation and backfilling.

The front 3 inches to 6 inches of reinforced slope backfill at the slope face, as shown in the Plans, shall be thoroughly mixed with lime, 16-16-16 fertilizer, and grass seed to create a vegetated face. Lime shall be applied at a rate 6.0 lbs/cy, fertilizer at a rate of 0.7 lbs/cy, and grass seed at a rate of 0.4 lbs/cy.

The Design-Builder shall compact the zone within one meter of the slope face without causing damage or distortion to the slope face or reinforcing layers by using light mechanical tampers approved by WSDOT. The maximum outward bulge of the face between primary reinforcement layers shall not exceed 3 inches.

Installing Guardrail Posts in Geosynthetic Reinforced Slopes

The Design-Builder shall install guardrail posts as shown in the Plans after completing the reinforced slopes. The Design-Builder shall install the posts in a manner that prevents bulging of the slope face and prevents ripping, tearing, or pulling of the geosynthetic reinforcement. Holes through the geosynthetic reinforcement shall be the minimum size necessary for the post. The Design-Builder shall demonstrate to WSDOT prior to beginning guardrail post installation that the installation method will not rip, tear, or pull the geosynthetic reinforcement.

DIVISION 3, PRODUCTION FROM QUARRY AND PIT SITES AND STOCKPILING

3-01 PRODUCTION FROM QUARRY AND PIT SITES

Material Sources, General Requirements

Section 3-01.2 is supplemented with the following:

Permits For Pit Operations In King County

The Design-Builder is advised that King County may require the Design-Builder to meet any or all of the following listed conditions before considering issuance of a temporary permit for pit operations within King County:

1. Security fences and locking gates shall be installed where deemed necessary by the King County Department of Building. Cable or wire gates are not acceptable.
2. Hours of operation shall be limited to: 7:00 a.m. to 7:00 p.m.
3. Access roads shall be improved and maintained to the satisfaction of the King County Department of Public Works. A haul road agreement for County road maintenance may be required.

All roads shall be swept, washed, or both, by the Design-Builder at the Design-Builder's expense as often as the Department of Building deems necessary.

Property shall have functional access to an arterial level street.

4. All operations will have to be approved by King County Flood Control for drainage plans, Washington State Department of Ecology, and Puget Sound Air Pollution Control Authority.

Those properties near or adjacent to any water body shall have written approval from the State of Washington Department of Fisheries.

The Design-Builder shall obtain a mining reclamation permit from the State of Washington Department of Natural Resources for sites of over three acres in size of disturbed land or resulting in pit walls more than thirty feet high and steeper than one to one slope.

5. No stockpiling of foreign excavated material is permitted on the site except for those materials to be used in the land rehabilitation of the subject property.
6. No signs other than signs required by Chapter 24.42, King County Zoning Code are authorized as a result of the temporary permit.
7. Plans required:

a. Scale of Plot Plans

Site Size: less than 10 acres 1 inch = 50 feet

b. Contours

Show existing and proposed contours at 5-foot intervals. If existing and proposed contours are superimposed upon one another it must be clear as to which is which. Plans which incorporate a screening process may be required by the County to distinguish said contours.

Finished contours must show how the property can be used under the existing zoning. Plans showing daylighting of property to road grade or below with high 2:1 slope walls will no longer be permitted within the R, S, or G zones. The plans must contain large terraces which will permit the lot sizes and roads that are permitted within the zone.

c. Sections

Show a minimum of two sections in each direction.

d. Maximum Slope

Cuts shall not be steeper in slope than two horizontal to one vertical unless the owner furnishes a soils engineering or an engineering geology report certifying that the site has been investigated and indicating that the proposed deviation will not endanger any private property or result in the deposition of debris on any public way or interfere with any existing drainage course.

e. Fill Slopes

No fill shall be made which creates an exposed surface steeper in slope than two horizontal to one vertical.

f. Benches on Slopes

There shall be a 10 foot wide bench sloped into the hillside for every 50 feet in height.

g. Setbacks

Material and vegetation shall be left in its natural state:

50 feet from any FP, A, G, S, or R zoned property;

20 foot setback which includes a 6 foot high planted berm along any public right-of-way;

20 feet from M, B, or CG zoned property;

10 feet from QM or FR zoned property.

Plans shall show type of vegetation existing within the buffer zones.

h. Drainage

All drainage facilities shall be designed to carry surface waters to the nearest practical street, storm drain, or natural water-course. Adequate provision shall be made to prevent any surface waters from

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
damaging the face of an excavation or fill. All slopes shall be
protected from surface water runoff from above by berms or swales.

The Design-Builder is further advised that King County may require conditions which are in addition to the foregoing list and that the County may reject permit applications at its discretion because of the proposed operations proximity to schools, residential neighborhoods, hospitals, arterials, or for other environmental conditions.

When there are discrepancies between the requirements of the State and the County the more stringent specifications shall apply.

Should the Design-Builder fail to comply with any requirements of a temporary permit obtained in WSDOT's name, the WSDOT will take the necessary action to meet these requirements and any costs incurred by the WSDOT will be deducted from monies due or to become due the Design-Builder.

DIVISION 4, BASES

4-04, BALLAST AND CRUSHED SURFACING

Construction Requirements

Shaping and Compaction

Section 4-04.3(5) is supplemented with the following:

The top surface of the final lift of surfacing material on each mainline roadway shall be trimmed using a trimming machine that maintains grade and transverses slopes automatically, through sensors that respond to reference lines on both edges of each roadway.

The minimum width to be trimmed shall be the travelled way plus sufficient width for the treads of the paving machine.

The trimmed surface shall be smooth and uniform with no chatter or ripples.

4-06, ASPHALT TREATED BASE

Materials

Section 4-06.2 is supplemented with the following:

The grade of paving asphalt used in asphalt treated base shall be PG *** \$\$1\$\$ *** unless otherwise ordered by WSDOT.

DIVISION 5, SURFACE TREATMENTS AND PAVEMENTS

5-04, HOT MIX ASPHALT

Construction Requirements

Hot Mix Asphalt Pavers

Section 5-04.3(3) is supplemented with the following:

For any course of hot mix asphalt (HMA) used in traffic lanes with a depth of 0.08 feet or greater the direct transfer of the HMA from the hauling equipment to the paving machine will not be allowed. A material transfer device or vehicle (MTD/V) shall be used to deliver the HMA from the hauling equipment to the paving machine.

The MTD/V shall mix the HMA after delivery by the hauling equipment but prior to laydown by the paving machine. Mixing of the HMA shall be sufficient to obtain a uniform temperature throughout the mixture. If a windrow elevator is used, the length of the windrow may be limited in urban areas or through intersections, at the discretion of WSDOT.

Preparation Of Existing Surfaces

Section 5-04.3(5)A is supplemented with the following:

The Contractor shall limit the amount of tack coat placed to that amount that will be fully covered by the asphalt overlay at the end of each work shift.

In accordance with the requirements of Chapter 3, Section 3.8.3.6.1.1, **SPCC PLAN**, as part of the SPCC the Contractor shall address the mitigating measures to be taken in the event that the paving operation is suspended or terminated prior to the asphalt for tack coat being fully covered.

Compaction

Control

The first sentence of item 1 in Section 5-04.3(10)B is revised to read:

HMA used in traffic lanes, including lanes for ramps, truck climbing, weaving, speed change, and shoulders, and having a specified compacted course thickness greater than 0.10 foot, shall be compacted to a specified level of relative density.

Section 5-04.3(10)B is supplemented with the following:

WSDOT may also evaluate the HMA for low cyclic density of the pavement. Low cyclic density areas are defined as spots or streaks in the pavement that are less than 89.0 percent of the reference maximum density. If four or more low cyclic density areas are identified in a lot, a cyclic density price adjustment will be assessed for that lot. The price adjustment will be calculated as 15% of the unit bid price for the quantity of HMA represented by that lot. Only one area per delivered truck and one area per delivered trailer of HMA will be counted toward the number of low cyclic density

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build areas. Any area tested for density under Section 5-04.3(10)B Control 1. General, will be included in this analysis.

Joints

Section 5-04.3(11) is supplemented with the following:

The HMA overlay shall be feathered to produce a smooth riding connection to the existing pavement.

HMA utilized in the construction of the feathered connections shall be modified by eliminating the coarse aggregate from the mix at the Design-Builder's plant or the commercial source or by raking the joint on the roadway, to the satisfaction of WSDOT.

Surface Smoothness

The second sentence of Section 5-04.3(13) is deleted and replaced with the following:

The completed surface of the wearing course of all other sections of highway shall not vary more than 1/8 inch from the lower edge of a 10-foot straightedge placed on the surface parallel to centerline.

Planing Bituminous Pavement

Section 5-04.3(14) is supplemented with the following:

The Design-Builder shall perform the planing operations no more than 14 calendar days ahead of the time the planed area is to be paved with HMA, unless otherwise allowed by WSDOT in writing.

At the start of the planing operation the Design-Builder shall plane a 500 foot test section to be evaluated by WSDOT for compliance with the surface tolerance requirements. The test section shall have a minimum width of 10 feet. If the planing is in accordance with the surface tolerance requirements, the Design-Builder may begin production planing. If the planing is not in conformance with the surface tolerance requirements, the Design-Builder shall make adjustments to the planing operation and then plane another test section.

If at any time during the planing operation WSDOT determines the required surface tolerance is not being achieved, the Design-Builder shall stop planing. Planing shall not resume until WSDOT is satisfied that specification planing can be produced or until successful completion of another test section. The forward speed during production planing shall not exceed the speed used for the test section.

The completed surface after planing and prior to paving shall not vary more than 1/4 inch from the lower edge of a 10-foot straightedge placed on the surface parallel or transverse to the centerline. The planed surface shall have a matted texture and the difference between the high and low of the matted surface shall not exceed 1/8 inch.

Pavement repair operations, when required, shall be accomplished prior to planing.

Transverse Joints

The full depth end of each lane of planing shall be squared off to form a uniform transverse joint. The Design-Builder shall construct and maintain a temporary HMA wedge in accordance with Section 5-04.3(11) across the entire width of the transverse edge when traffic is allowed on the planed surface prior to paving. The wedge shall be constructed before opening the lane to traffic. The Design-Builder shall remove the wedge immediately prior to paving.

Beveled Edge Planing

A beveled edge shall be constructed in areas with a planed depth of more than 0.20 foot that will not be paved during the same work shift.

The Design-Builder shall use a beveled cutter on the mandrel of the planing equipment, or other approved method(s), to eliminate the vertical edge(s). The beveled edge(s) shall be constructed at a 4:1 slope.

Removing Existing Pavement Surfacing Overlay from Bridge Deck

The Contractor shall remove the existing pavement surfacing overlay from the roadway deck of Bridge No(s) *** 405/56E and 405/56W ***. The depth of removal shall be to the top of the cement concrete surface of the bridge deck.

The Contractor shall submit the method and equipment proposed for the removal operation to the Engineer for approval. The Contractor shall demonstrate to the satisfaction of the Engineer that the proposed removal method and equipment are adequate for the intended purpose and will provide satisfactory results. The existing bridge deck may be rutted in the wheel lines. The Contractor shall use whatever means necessary, with the approval of the Engineer, to remove the existing pavement surfacing overlay from the rutted areas. The Contractor shall not begin bridge deck pavement surfacing removal operations until receiving the Engineer's approval of the removal method and equipment.

The Contractor's bridge deck pavement surfacing removal operations shall not damage the existing concrete bridge deck. All damage to the existing concrete bridge deck due to the Contractor's bridge deck pavement surfacing removal operations shall be repaired in accordance with Section 1-07.13 and as approved by the Engineer.

Following removal of the existing pavement surfacing overlay, the Contractor shall perform bridge deck repair, as determined by the Engineer, in accordance with Section 6-02.3(10) as supplemented in these Special Provisions.

Weather Limitations

The first sentence of Section 5-04.3(16) is revised to read:

HMA for wearing course shall not be placed on any travelled way between October 1 and April 1 of the following year without written approval from WSDOT.

5-05, CEMENT CONCRETE PAVEMENT

Construction Requirements

Concrete Mix Design for Paving

When combined aggregate concrete gradation is used, item 3 in Section 5-05.3(1) is revised to read as follows:

Reinforced Concrete Bridge Approach Slabs

Section 5-05.3(19) is supplemented with the following:

The pavement end of the approach slab shall be constructed normal to the roadway center line.

The compression seal shall be D.S. Brown, CV-2502; Watson Bowman Acme, WA-250; ESCO, X-2500; Structural Accessories Inc., SA-2500, or approved equal.

DIVISION 6, STRUCTURES

GENERAL REQUIREMENTS FOR STRUCTURES

MODULAR EXPANSION JOINT SYSTEM

Description

1.01 Modular Expansion Joint System

- A. This item of work shall consist of furnishing material, services, labor, tools, equipment, and incidentals necessary to design, fabricate, inspect, test, and install each expansion joint system as specified.
- B. Each expansion joint system shall consist of a modular, multiple seal expansion joint as designated and noted in the Plans.
- C. Each expansion joint system shall accommodate the movements specified in the Plans.
- D. Each expansion joint system shall extend continuously across the full width of the roadway and up into the traffic barriers as shown in the Plans.

Materials

2.01 Structural Steel

- A. Structural steel shall conform to ASTM A 36, ASTM A 572 Grade 50, or ASTM A 588. Aluminum components shall not be used.

2.02 Stainless Steel

- A. Stainless steel shall conform to ASTM A 240 Type 304.

2.03 Aluminum

- A. Aluminum components shall not be used.

2.04 Polytetrafluorethylene (PTFE)

- A. PTFE shall be 100% virgin teflon, woven PTFE fabric, or dimpled PTFE conforming to the requirements of Section 18.8 of the AASHTO LRFD Bridge Construction Specifications.

2.05 Expansion Joint Seals

- A. The maximum size of each expansion joint strip seal shall be 3 inches. Box-type seals or seals utilizing double webs will not be acceptable. Seals shall be continuous without splices.

<u>Property</u>	<u>Test Method</u>	<u>Range of Values</u>
Hardness, Durometer A	ASTM D2240	55 -70
Tensile Strength	ASTM D412	2000psi minimum
Elongation at break	ASTM D412	250%
Compression Set, at 72 hr. at 212F	ASTM D395	40%

2.06 Bolts, Nuts, Washers

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

- A. Bolts and other hardware shall conform to the requirements of AASHTO M 164 Type 1 or 2 and shall be galvanized in accordance with AASHTO M 232 and Section 9-06.5(3) of the Standard Specifications.

2.07 Other Materials

- A. Other materials shall meet the requirements of the Standard Specifications and this Special Provision.

Construction Requirements

3.01 Acceptable Manufacturers

- A. Only manufacturers whose modular expansion joint systems have met the fatigue resistance characterization requirements stipulated in Section 3.07.A of this Special Provision will be permitted to supply modular expansion joint systems. Any testing required to establish the fatigue resistance of all details of a specific proprietary system shall be completed prior to the contract award date. All fatigue testing shall be conducted in accordance with Sections 3.10, 3.11, and 3.12 of this Special Provision. Testing shall be completed on any revised details or material substitutions of a previously prequalified system prior to the contract award date.
- B. The following manufacturers are known to have prequalified modular expansion joint system details by completing fatigue testing in accordance with these requirements:

1. The D.S. Brown Company

P.O. Box 158
300 E. Cherry Street
North Baltimore, Ohio 45872-0158
Tel. (419) 257-3561
Fax (419) 257-2200

2. Watson Bowman ACME Corporation

95 Pineview Drive
Amherst, New York 14228-2166
Tel. (716) 691-7566
Fax (716) 691-9239

3.02 Submittals

- A. Manufacturer Qualifications

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

1. The expansion joint manufacturer shall have at least three years of experience in designing and manufacturing modular expansion joint systems. The Design-Builder shall provide written certification of the manufacturer's experience to WSDOT. This certification shall include the location of each bridge, installation date, governmental agency/owner, and the name, address, and telephone number of each owner's/agency's representative.
2. The Design-Builder shall submit the name of the selected expansion joint system manufacturer to WSDOT within 10 days of contract award. Once the name of the manufacturer has been submitted to WSDOT, the Design-Builder shall not select an alternative expansion joint system manufacturer unless the manufacturer demonstrates an inability to meet the requirements of this Special Provision.

B. Shop Drawings and Design Calculations

1. The Design-Builder shall submit shop drawings and design calculations delineating the expansion joint system to WSDOT for approval prior to fabrication of the joint, in accordance with Sections 6-01.9 and 6-03.3(7) of the Standard Specifications and as noted herein. The Professional Engineer responsible for preparing and stamping the submittal shall be an employee of the expansion joint system manufacturer, and shall hold a valid license in the branch of Civil or Structural Engineering, either in the State of Washington or another state. These submittals shall include, but shall not be limited to, the following:
 - a. Plan, elevation, and section of the joint system for each movement rating and roadway width. All dimensions and tolerances shall be specified.
 - b. Sections showing all materials composing the expansion joint system with complete details of all individual components including all bolted and welded splices and connections.
 - c. All ASTM, AASHTO, or other material designations.
 - d. Installation plan including sequence, lifting mechanisms and locations, details of temporary anchorage during setting, temperature adjustment devices, opening dimensions relative to temperature, installation details at curbs, and seal installation details.
 - e. Plan for achieving watertightness including details related to performing the watertightness test required in Section 3.21.G of this Special Provision.
 - f. Details and material designations pertinent to the corrosion protection system.
 - g. Requirements and details related to the temporary support of the joint system for shipping, handling, and job site storage.
 - h. Design calculations for all structural elements including all springs and bearings. The design calculations shall include fatigue design for all structural elements, connections, and splices.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

- i. Welding procedures in compliance with the current AASHTO/AWS D1.5 Bridge Welding Code.
 - j. A written maintenance and part replacement plan to facilitate replacement of parts subject to wear. This plan shall include a list of parts, instructions for maintenance inspection, acceptable wear tolerances, methods for determining wear, procedures for replacing worn parts, and procedures for replacing seals.
 - k. Any required modifications to blackout reinforcing steel to accommodate the expansion joint system.
- C. Documentation, Certifications, and Test Reports
1. At the time of shop plan submittal, the Design-Builder shall submit to WSDOT for approval the following documentation:
 - a. Documentation that the manufacturer is certified through the AISC Quality Certification Program under the category *Simple Steel Bridge Structures*.
 - b. Documentation that welding inspection personnel are qualified and certified as welding inspectors under AWS QC1, Standard for Qualification and Certification of Welding Inspectors.
 - c. Documentation that personnel performing nondestructive testing (NDT) are qualified and certified as NDT Level II under the American Society for Nondestructive Testing (ASNT) Recommended Practice SNT-TC-1a.
 2. The Design-Builder shall submit to WSDOT for approval prior to fabrication the following test reports and certificates of compliance:
 - a. Manufacturer's certificate of compliance for all polytetrafluorethylene (PTFE) sheeting, PTFE fabric, and elastomer.
 - b. Certified mill test reports for all steel and stainless steel in the expansion joint system assemblies.

Certified test reports confirming that the springs and bearings meet the design load requirements.
 3. Upon completion of installation, the Design-Builder shall submit to WSDOT certification stating that each expansion joint system was installed in accordance with the approved shop plan installation procedure. This certification shall comply with the requirements stipulated in Section 3.21.A of this Special Provision.
- D. Method for Temporary Bridging of Construction Loads
1. The Design-Builder shall submit to WSDOT for approval a temporary bridging method for each expansion joint system over which construction traffic is anticipated to cross following its installation. This submittal shall comply with the requirements stipulated in Section 3.21.D of this Special Provision.
- E. Quality Assurance Inspection Documentation

1. The Design-Builder shall submit to WSDOT documentation of a Quality Assurance Inspection program performed by an independent inspection agency provided by the manufacturer. The name of the independent inspection agency, details of the proposed quality assurance inspection program including inspection frequency, and all applicable reporting forms shall be submitted to WSDOT for approval prior to the start of fabrication.

F. Warranty

1. The Design-Builder shall provide a five year written warranty guaranteeing the performance and durability of the expansion joint system. Conditions constituting unsatisfactory performance and durability include, but shall not be limited to, broken welds or bolts (including field splices), cracks in steel members, fatigue damage, loss of precompression in springs or bearings, debonded PTFE, breakdown of corrosion protection, and leakage. The Design-Builder shall replace or repair any expansion joint system component demonstrating unsatisfactory performance or durability within the five year period commencing from the date of completion of the contract. All material and labor costs shall be paid by the Design-Builder.

3.03 General Design Requirements

- A. The expansion joint system shall be designed and detailed with adequate access to all internal components in order to assure the feasibility of inspection and maintenance activities.
- B. The expansion joint system shall be designed and detailed to minimize concrete cracking above the support boxes. Measures taken shall include, but not be limited to, assuring adequate support box top plate thickness, specifying any additional roadway deck steel reinforcement required, and providing adequate concrete cover.
- C. The expansion joint system and roadway deck steel reinforcement shall be detailed to assure that adequate concrete consolidation can be achieved underneath all support boxes.
- D. The expansion joint seals shall not protrude above the top of the expansion joint system under any service condition. Split extrusions may be used at curb upturns.
- E. The elastomeric or urethane springs and bearings shall be designed to be removable and replaceable. The removal and reinstallation of each strip seal shall be easily accomplished from above the joint with a 1-1/4 inch minimum gap width. These operations shall be viable with a one lane partial closure of the roadway.
- F. The expansion joint system shall be designed and detailed to be watertight.
- G. The expansion joint system shall be designed and detailed to accommodate all movements specified on the plans.
- H. The expansion joint shall be designed and detailed to mitigate the potential for fatigue damage wherever centerbeam field splices are required.

Consideration shall be given to reducing support box spacing and optimizing splice location between adjacent support boxes in order to minimize fatigue stress range at field splices.

3.04 Design Axle Loads and Impact Factors

- A. The centerbeams, support bars, bearings, connections, and other structural components shall be designed for the simultaneous application of vertical and horizontal loads from a tandem axle. The tandem axle shall consist of a pair of axles spaced four feet apart with vertical and horizontal loads as specified in subsections B, C, D, and E below. The transverse spacing of the wheels shall be six feet. The distribution of the wheel load among centerbeams shall be as stipulated in Section 3.05 of this Special Provision.
- B. The vertical load range for fatigue design shall be a 32.0 kip tandem. This tandem shall be taken as two 16.0 kip axles spaced four feet apart. Only one of these tandem axles must be considered in the design, unless the joint opening exceeds four feet. The load range shall be increased by the dynamic load allowance (Impact Factor) of 75%. Load factors shall be applied in accordance with Table 3.4.1-1 of the AASHTO LRFD Bridge Design Specifications - Second Edition.
- C. The vertical load for strength design shall be a 50.0 kip tandem. This tandem shall be taken as two 25.0 kip axles spaced four feet apart. Only one of these tandem axles must be considered in the design, unless the joint opening exceeds four feet. This load shall be increased by the dynamic load allowance (Impact Factor) of 75%. Load factors shall be applied in accordance with Table 3.4.1-1 of the AASHTO LRFD Bridge Design Specifications - Second Edition.
- D. The horizontal load range for fatigue design shall be 20% percent of the amplified vertical load range (LL+IM) specified in Section 3.04.B of this Special Provision. For modular expansion joint systems installed on vertical grades in excess of five percent, the horizontal component of the amplified vertical load range (LL+IM) specified in Section 3.04.B of this Special Provision shall be added to this horizontal load range.
- E. The horizontal load for strength design shall be 20 percent of the amplified vertical load (LL+IM) specified in Section 3.04.C of this Special Provision. For modular expansion joint systems installed on vertical grades in excess of five percent, the horizontal component of the amplified vertical load (LL+IM) specified in Section 3.04.C of this Special Provision shall be added to this horizontal load.

3.05 Distribution of Wheel Loads

- A. The following table specifies the centerbeam distribution factor as a function of centerbeam top flange width. This factor is the percentage of the design vertical axle load and the design horizontal axle load which shall be applied to an individual centerbeam for the design of that centerbeam and its associated support bars. Distribution factors shall be interpolated for centerbeam top flange widths between those explicitly denoted in the table. In no case shall the distribution factor be taken as less than 50%. The remainder of the load shall be divided equally and applied to the two adjacent centerbeams or edge beams.

Width of Centerbeam Top Flange	Distribution Factor
2.5 inches	50%
3.0 inches	60%
4.0 inches	70%
4.75 inches	80%

3.06 Fatigue Limit State Design Requirements

- A. Modular expansion joint system structural members, bolted and welded splices and connections, and attachments shall be designed to resist the Fatigue Limit State load combination specified in Table 3.4.1-1 of the AASHTO LRFD Bridge Design Specifications - Second Edition. The vertical and horizontal load ranges specified in Section 3.04 of this Special Provision shall be applied simultaneously. These loads shall be distributed as specified in Section 3.05 of this Special Provision.
- B. The nominal stress ranges, Δf , at all fatigue critical details shall be obtained from a structural analysis of the expansion joint system applying the design vertical and horizontal load ranges specified in Section 3.04 of this Special Provision and distributed as specified in Section 3.05 of this Special Provision. The expansion joint system shall be analyzed with a minimum gap opening corresponding to the midrange configuration (at least half of the maximum gap opening). The design axle load shall be applied as two wheel loads, each having a transverse width of 20 inches. For each detail under consideration, the wheel loads shall be positioned transversely on a centerbeam to achieve the maximum nominal stress range at that detail. The vertical and horizontal wheel loads shall be applied as line loads to the top of the centerbeams at their centerlines. The design stress range in the centerbeam-to-support bar connection shall be calculated according to subsections 1 and 2 below. The design nominal stress ranges, Δf , shall be used for fatigue design as specified in Section 3.06.C of this Special Provision.
 1. Welded or Bolted Single-Support-Bar Systems
 - a. The nominal stress range, Δf , in the centerbeam at a welded or bolted stirrup shall be the sum of the longitudinal bending stress ranges at the critical section resulting from vertical and horizontal loading. The effects of stresses in any load-bearing attachments such as the stirrup or yoke shall not be considered when calculating the longitudinal stress range in the centerbeam. For bolted single-support-bar systems, stress ranges shall be calculated using the net section.
 - b. The nominal stress range, Δf , in the stirrup or yoke shall be calculated without considering the effects of stresses in the centerbeam. The stress range shall be calculated by assuming a load range in the stirrup equal to 30% of the total vertical reaction force between the centerbeam and the support bar. The effects of horizontal loads may be neglected in the design of the stirrup.

2. Welded Multiple-Support-Bar Systems

Three locations have been identified as initiation sites for fatigue cracking at a centerbeam-to-support bar welded connection. The types of cracking associated with these three locations are described below. The corresponding equations may be used to calculate the nominal stress range, Δf . For the support bar, either the reduced moment at the critical cross section or the moment at the centerline of the connection may be used in these equations.

- a. Centerbeam weld toe cracking is driven by a combination of longitudinal bending stress range, S_{RB} , in the centerbeam, and vertical stress range, S_{RZ} , at the top of the connection weld.

The longitudinal bending stress range, S_{RB} , at the bottom of the centerbeam shall be calculated as:

$$S_{RB} \equiv M_{Vcb} / S_{Xcb} + M_{Hcb} / S_{Ycb}$$

The vertical stress range, S_{RZ} , at the top of the connection weld shall be calculated as:

$$S_{RZ} \equiv R_H \cdot d_{cb} / S_{Wtop} + R_V / A_{Wtop}$$

- b. Support bar weld toe cracking is driven by a combination of longitudinal bending stress range, S_{RB} , in the support bar and vertical stress range, S_{RZ} , at the bottom of the connection weld.

The longitudinal bending stress range, S_{RB} , at the top of the support bar shall be calculated as:

$$S_{RB} \equiv M_{Vsb} / S_{Xsb} + 0.5 \cdot R_H \cdot (d_{cb} + h_W + 0.5 \cdot d_{sb}) / S_{Xsb}$$

The vertical stress range, S_{RZ} , at the bottom of the connection weld shall be calculated as:

$$S_{RZ} \equiv R_H \cdot (d_{cb} + h_W) / S_{Wbot} + R_V / A_{Wbot}$$

- c. Weld throat cracking is driven by a vertical stress range at the weld throat.

The vertical stress range, S_{RZ} , at mid-height of the connection weld shall be calculated as:

$$S_{RZ} \equiv R_V / A_{wmid} + R_H \cdot (d_{cb} + 0.5 \cdot h_W) / S_{Wmid}$$

In the above equations:

R_V \equiv vertical reaction at the connection weld

R_H \equiv horizontal reaction at the connection weld

M_{Vcb} \equiv bending moment in the centerbeam due to applied vertical forces

M_{Hcb} \equiv bending moment in the centerbeam due to applied horizontal forces

M_{Vsb} \equiv bending moment in the support bar due to applied vertical forces

S_{Xcb} \equiv section modulus at bottom of the centerbeam about horizontal axis

S_{Ycb} \equiv section modulus of the centerbeam about vertical axis

S_{Xsb} \equiv section modulus at top of the support bar about horizontal axis

A_{Wtop} ≡ area of the weld at the top of the connection

A_{Wmid} ≡ area of the weld at the middle of the connection

A_{Wbot} ≡ area of the weld at the bottom of the connection

S_{Wtop} ≡ section modulus of the weld at the top of the connection

S_{Wmid} ≡ section modulus of the weld at the middle of the connection

S_{Wbot} ≡ section modulus of the weld at the bottom of the connection

h_w ≡ height of the weld

d_{cb} ≡ depth of the centerbeam

d_{sb} ≡ depth of the support bar

The nominal stress range, Δf , at welded multiple-support-bar connection details shall be calculated for each case above as follows:

$$\Delta f = (S_{RB}^2 + S_{RZ}^2)^{1/2}$$

where

S_{RB} ≡ longitudinal stress range in the centerbeam or support bar, as calculated for each specific case above.

S_{RZ} ≡ vertical stress range in the centerbeam-to-support bar connection weld, as calculated for each specific case above.

- C. To assure an infinite fatigue life, all modular expansion joint system structural members, connections (bolted and welded), splices, and attachments shall satisfy the following:

$$\Delta f \leq F_{TH} / 2$$

where:

Δf ≡ the nominal stress range as specified in Section 3.06.B of this Special Provision.

F_{TH} ≡ constant amplitude fatigue threshold (CAFL) as specified in Section 3.07.A of this Special Provision.

3.07 Fatigue Resistance of Details

- A. The fatigue resistance of all details shall be characterized in terms of the fatigue categories specified in Table 6.6.1.2.5-1 of the AASHTO LRFD Bridge Design Specifications - Second Edition. Many details composing modular expansion joint systems may clearly correspond to specific structural details depicted in Figure 6.6.1.2.3-1 of the AASHTO LRFD Bridge Design Specifications - Second Edition. In these cases, the applicable fatigue categories specified in Table 6.6.1.2.3-1 may be used for design. In cases where WSDOT establishes that a detail does not clearly correspond to a structural detail depicted in Figure 6.6.1.2.3-1, fatigue testing of specimens exhibiting that detail shall be conducted, in accordance with Sections 3.10 through 3.13.A of this Special Provision, to establish the appropriate constant amplitude fatigue limit (CAFL) for that detail.

3.08 Strength I Limit State Design Requirements

- A. Modular expansion joint system structural steel members, connections (bolted and welded), splices, and attachments shall be designed to resist the Strength I Limit State load combination specified in Table 3.4.1-1 of the AASHTO LRFD Bridge Design Specifications - Second Edition. The vertical and horizontal loads specified in Section 3.04 of this Special Provision shall be applied simultaneously. These loads shall be distributed as specified in Section 3.05 of this Special Provision.

3.09 Design Reference

- A. Provisions contained in Sections 3.04 through 3.08.A of this Special Provision have been developed from research summarized in National Cooperative Highway Research Program Report 402 "Fatigue Design of Modular Bridge Expansion Joints", National Academy Press, Washington DC, 1997.

3.10 Fatigue Testing of Metallic Structural Components and Connections

A. Methodology

1. This test procedure is acceptable for, and specifically applicable to, establishing the fatigue resistance of the centerbeam-to-support bar connection in modular expansion joint systems. It is applicable to single-support-bar and multiple-support-bar systems having either welded or bolted centerbeam-to-support bar connections. The same methodology may be applied to establish the fatigue resistance of other modular expansion joint metallic structural component details, including centerbeam splices.
2. Each fatigue test generates a discrete datum. Each datum comprises an applied constant amplitude nominal stress range, S_r , and the corresponding number of cycles, N , associated with either a predetermined extent of crack propagation, defined as failure, or with termination of the test, defined as runout. Ten data shall be acquired for each connection detail. All data shall be in the very long life range, corresponding as closely to the constant amplitude fatigue limit (CAFL) as practical. Specifically, the number of cycles, N , associated with each datum, shall be no less than one order of magnitude less than N_{min} corresponding to the detail category specific CAFL specified in Section 3.10.G.1 of this Special Provision. For example, to characterize a detail as Detail Category C, the tested number of cycles, N , shall exceed 4.4×10^5 for each datum.
3. The constant amplitude nominal stress range shall be calculated at the anticipated initiation location of an incipient crack. Nominal stresses shall be calculated using conventional equations for analyzing bending and axial load. These equations are essentially the same as those used in strength design. The stress concentration effects of a weld, bolt hole, or other local features are not explicitly embodied in the conventional nominal stress equations.
4. The appropriate AASHTO detail category applicable to fatigue design shall be established by comparing acquired test data to fatigue resistance graphs representing the AASHTO detail categories. The constant

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
amplitude fatigue limit (CAFL) applicable to fatigue design corresponds to the AASHTO detail category fatigue resistance graph representing a lower bound of the experimentally acquired data.

5. When testing is conducted exclusively in the infinite life regime and more stringent test data scatter requirements are satisfied, a unique CAFL (different from those CAFL corresponding to specific detail categories specified by AASHTO) may be established for fatigue design.

B. Specimens

1. Specimens selected for testing shall be full-scale centerbeam and support bar assemblies or subassemblies representative of those installed in field applications. A subassembly is defined as a specimen having the same physical and geometric properties as an assembly but having a reduced number of centerbeams.
2. Each specimen shall consist of three continuous centerbeam spans over four equally spaced support bars. Centerbeam spans between adjacent support bar centerlines shall be a minimum of 3'-0" and a maximum of 4'-6". Support bar spans shall be a minimum of 3'-0" and a maximum of 3'-8". The centerbeam-to-support bar connection being tested shall be located at the midspan of each support bar.
3. Any welded or bolted attachments used to secure equidistant springs to a support bar, centerbeam, or stirrup shall be fabricated as an integral part of the specimen. A rigid load path to the test fixture shall be provided to resist any horizontal forces or displacements which would normally be resisted through these attachments in a field installation. Any miscellaneous welded or bolted attachments, including welded attachments used to secure the expansion joint strip seals to the centerbeams, shall also be fabricated as integral parts of the specimen.
4. Support bars of subassembly specimens that are components of single-support-bar swivel-joist type modular expansion joint systems shall be oriented perpendicular to the longitudinal axis of the centerbeam.
5. Prior to testing, each specimen shall be visually inspected for any defects, loose fasteners or other aberrations which could plausibly affect the tested fatigue resistance. Defects and flaws shall be defined in accordance with the appropriate governing specification (ASTM A-6, AWS D1.5, etc.). Data acquired from specimens containing such anomalies shall not be excluded from consideration except as permitted in Section 3.10.G.2.c of this Special Provision. Any observed anomaly shall also be reported with its corresponding data in the tabular format stipulated in Section 3.10.H of this Special Provision.

C. Instrumentation

1. Each specimen shall be sufficiently instrumented to measure the static nominal strain range within that specimen for a specific applied load range. Best results can generally be obtained when the applied load range for the static calibration tests does not pass through zero load. Strain measurements shall be made at locations sufficiently distant from local effects, such as weld toes or bolt holes, which could significantly influence acquired test data.

2. As a minimum, eight strain gages shall be installed on the centerbeam top flange in the vicinity of each centerbeam-to-support bar connection. These gages shall be installed in pairs on each side of the connection at distances of one and two times the depth of the centerbeam from the centerline of the connection. Each pair of strain gages shall be located symmetrically about the centerline of the centerbeam. As a minimum, two strain gages shall also be installed on the support bar bottom flange in the vicinity of each centerbeam-to-support bar connection. One of these strain gages shall be installed on each side of the connection at a distance equal to the depth of the support bar from the centerline of the connection. These strain gages shall be installed along the centerline of the support bar.

D. Test Fixtures

1. Test fixtures shall have the capability to adequately support and secure the specimen throughout the duration of the test. The fixture shall be designed and fabricated to such tolerances as required to assure that additional stresses will not be generated in the specimen as a consequence of fixture misalignment. Mismatches resulting from specimen fabrication errors shall be accommodated by shimming or other such means precluding the application of force to the specimen.
2. Typical elastomeric bearings and springs used to transfer vertical loads from the support bars to the support boxes may be replaced with steel bearings in the test fixture. This modification will enable fatigue testing at higher load ranges and different frequencies than those encountered during normal service conditions.
3. Load shall be applied through two 10 inch long patches. Each patch shall typically comprise a steel plate and a hard rubber bearing pad placed in contact with the bottom flange of the centerbeam. Each patch shall be located at midspan of each outer span.
4. In order to assure adequate seating of the specimen to the test fixture, a minimum of 10 kips shall be applied at each patch location. This requirement is waived for tests of single support bar systems conducted using load reversal. Once this load has been applied, all strain measuring devices shall be rebalanced to zero strain while the preload is maintained. An additional load approximately equivalent to the calculated load range shall be applied. Strain ranges shall be measured for the load range from 10 kips to the peak load. Each static calibration test shall be repeated three times while still maintaining a minimum 10 kips load at each load patch. The measured strain ranges from each repetition should vary by no more than 25% from the mean value. If the stress ranges are not repeatable, appropriate modifications shall be made to the test fixture.

E. Static Calibration Test

1. Prior to any fatigue resistance testing, a static calibration test shall be performed in order to validate the structural analysis model. The static calibration test shall be performed after attainment of stress range repeatability as described in Section 3.10.D.4 of this Special Provision. The structural analysis model shall be considered validated when calculated strain ranges are within $\pm 25\%$ of the measured strain ranges at every strain gage location.
2. For the purpose of reporting nominal fatigue resistance stress ranges at specific details, stress ranges determined through structural analysis of the model shall be preferred over stress ranges acquired directly from test measurements.

F. Test Procedure

1. A minimum of ten data points shall be required to establish the fatigue resistance of each detail. The centerbeam-to-support bar connection shall be considered as a single detail.
2. Several data points may be obtained from a single specimen by repairing the cracked sections of that specimen and resuming testing. Such repairs shall have minimal effect on the stress ranges at unfailed details still being tested. Data points derived from tests in which a repaired detail cracks again shall be discarded.
3. All data shall be in the very long life range, corresponding as closely to the constant amplitude fatigue limit as practical, but in no case less than 200,000 cycles. Either finite life regime or infinite life regime testing may be conducted. For infinite life regime testing, the number of cycles, N , associated with each of the ten data shall be at least twice the number of cycles, N_{min} , designated in the table in Section 3.10.G.1 of this Special Provision.
4. Loads shall be applied using hydraulic actuators or other similar loading devices. The magnitude of the vertical load range, ΔP_v , shall be maintained and continuously monitored throughout the duration of the test. Vertical and horizontal load ranges shall be applied to the specimen simultaneously. The horizontal load range shall always be equal to 20% of the vertical load range, ΔP_v . This horizontal-to-vertical load ratio may be maintained by inclining the specimen 11.3 degrees with respect to the horizontal plane and applying load through vertically oriented actuators.
5. For multiple support bar systems, the loading mechanism shall be either exclusively tension or exclusively compression and shall be applied at a constant amplitude at any desired frequency. The applied load range shall be in a direction such that the reaction force between the centerbeam and support bar is always tensile. The load range shall not pass through zero load. Minimum preload shall be maintained throughout the duration of the test.
6. Single support bar systems may be loaded using the same procedures as those for multiple support bar systems. If premature stirrup failure occurs, an applied load range of 70% compression and 30% tension may be used.

7. The load ranges used in the test shall not be so large as to alter the observed failure mode from that which would be observed under service conditions. Under no circumstance shall imposed stress exceed the yield stress of the material in any portion of the specimen. Each specimen shall be tested using at least two different load (stress) ranges.
8. If infinite life regime testing is conducted, the first load range should be chosen so that the applied stress range is just above the postulated CAFL. The load range in the subsequent test shall be decreased if failure resulted and increased if the test resulted in a runout. A suggested increment in load is such that the stress range is increased or decreased by 2 ksi. The applicable CAFL shall be selected from those CAFL values corresponding to the AASHTO fatigue categories. The selected CAFL is the one just below the lowest stress range that resulted in cracking.
9. The following criteria shall be used to define failure of a given centerbeam-to-support bar connection:
 - a. Welded Centerbeam-to-Support Bar Connections
 1. Centerbeam weld toe cracking originates at or near the centerbeam weld toe, propagates up into the centerbeam at some angle, and grows back over the connection. These cracks typically grow at an angle of about 45 degrees. A specimen shall be considered as failed due to this type of cracking when the crack has grown on any vertical face a length from the point of origin equal to half of the centerbeam depth.
 2. Support bar weld toe cracking originates at or near the support bar weld toe, propagates down into the support bar, and grows back under the connection at some angle, typically about 45 degrees. A specimen shall be considered as failed due to this type of cracking when the crack has grown on any vertical support bar face a length from the point of origin equal to half of the depth of the support bar.
 3. Weld throat cracking originates in the weld throat and typically grows in a plane parallel to the longitudinal axis of the support bar at about mid-depth of the weld throat. A specimen shall be considered as failed due to this type of cracking when a complete fracture of the weld throat has occurred. These cracks have been observed to turn down into the support bar, but only after significant growth. In such instances, the criteria for support bar weld toe cracking shall be applied.
 - b. Welded Stirrup Connections
 1. A specimen shall be considered as failed when cracks result in the complete fracture of any stirrup leg or when cracks originating at or near a stirrup weld have grown into any face of the centerbeam a length from the stirrup weld toe equal to half of the centerbeam depth.

c. Bolted Centerbeam-to-Support Bar Connections

1. A specimen shall be considered as failed when:
 - i. Fatigue cracks which have grown out of a bolt hole have resulted in the complete fracture of the tension flange of the centerbeam.
 - ii. Fatigue cracks which have grown out of a bolt hole have extended into any face of the centerbeam web a distance equivalent to half of the centerbeam depth less the centerbeam flange thickness.
 - iii. Any portion of a stirrup fractures completely.
 - iv. Any single bolt fractures completely.

10. Alternate Criteria for Termination of a Finite Life Regime Test

- a. A test may also be terminated when, for a given stress range, the specimen has survived the number of cycles required to plot the data above either a particular fatigue resistance curve or the maximum permitted in Section 3.10.G.2.d of this Special Provision. For example, if the applied stress range is 17 ksi and the desired fatigue resistance curve is Category C, then based upon the equation presented in Section 3.10.G.1 of this Special Provision, the test may be terminated after application of about 900,000 cycles provided that the specimen has not failed based on the above described criteria.

11. Nominal Stress Range Calculation

- a. Welded Centerbeam-to-Support Bar Systems
 1. The nominal stress range for centerbeam weld toe cracking shall be calculated by taking the square root of the sum of the squares of the longitudinal bending stress range in the centerbeam and the vertical stress range at the top of the weld.
 2. The nominal stress range for support bar weld toe cracking shall be calculated by taking the square root of the sum of the squares of the longitudinal bending stress range in the support bar and the vertical stress range at the bottom of the weld.
 3. The nominal stress range for weld throat cracking shall be the calculated vertical stress range in the throat of the weld.
 4. The nominal stress range in the centerbeam at a welded stirrup shall be calculated as the summation of the longitudinal bending stress ranges at the critical section resulting from vertical and horizontal loading. The entire load range shall be used in the calculation, even if the loading is partly in compression. The effects of stresses in any load-bearing attachments such as the stirrup or yoke shall not be considered when calculating the nominal stress range in the centerbeam.

The load range in the stirrup itself shall be taken as 30% of the total vertical load range carried through the connection. The effect of horizontal forces may be neglected.

b. Bolted Systems

1. The nominal stress range in the centerbeam shall be taken as the summation of the longitudinal bending stress ranges in the centerbeam resulting from vertical and horizontal loading. Nominal stress ranges shall be calculated using the net section. The effects of stresses in the stirrup shall not be considered when calculating the nominal stress range in the centerbeam.
2. The nominal load range in the bolt group and the stirrup assembly shall be taken as 30% of the total vertical load range carried through the connection. The effect of horizontal forces may be neglected.

G. Interpretation of Test Data

1. The experimentally acquired data and graphs representing the fatigue resistance of the detail categories delineated in Section 6.6 of the AASHTO LRFD Bridge Design Specifications - Second Edition shall be juxtaposed on a log-log scale. The equation representing the finite life fatigue resistance of these AASHTO detail categories is:

$$N \equiv A / S_{r,eff}^3$$

where:

N ≡ number of cycles to failure.

$S_{r,eff}$ ≡ nominal effective stress range representing fatigue resistance.

A ≡ constant defined in Table 6.6.1.2.5-1 of the AASHTO LRFD Bridge Design Specifications - Second Edition.

The minimum number of cycles associated with infinite fatigue life, N_{min} , and the corresponding constant amplitude fatigue limit (CAFL) for each AASHTO detail category is designated in the table below.

Detail Category	N_{min} (infinite fatigue life)	CAFL(ksi)
A	1.8×10^6 cycles	24
B	3.0×10^6 cycles	16
B'	3.5×10^6 cycles	12
C	4.4×10^6 cycles	10
C'	2.5×10^6 cycles	12
D	6.4×10^6 cycles	7.0
E	1.2×10^7 cycles	4.5
E'	2.2×10^7 cycles	2.6

2. Finite Life Regime Testing

- a. The number of cycles, N , to either failure or runout, associated with each of the ten data need not exceed N_{min} , designated in the table in Section 3.10.G.1 of this Special Provision.
- b. The detail category applicable to fatigue design shall be that corresponding to the highest of the AASHTO detail category fatigue resistance graphs representing a lower bound of all ten experimentally acquired data.
- c. If all but one datum falls above a selected AASHTO S-N curve, that one datum may be discarded and replaced by three new data obtained through additional testing. The additional testing shall be conducted using the same stress range as that of the discarded datum. The three additional data shall be plotted along with the remaining nine data. The applicable detail category shall be that corresponding to the highest of the AASHTO detail category fatigue resistance graphs representing a lower bound of all twelve data, except as limited in the previous table. For any detail, only one datum may be discarded and subsequently replaced with three additional data for any set of ten original data.
- d. The maximum fatigue resistance of any detail shall not exceed that associated with the fatigue category prescribed in the table

Type of Detail	Maximum Permitted Category
Welded Multiple Centerbeam-to-Support Bar Connections	C
Weld Stirrup Attachments for Single Support Bar Systems	B
Bolted Stirrup Attachments for Single Support Bar Systems	D
Groove Welded Centerbeam Splices ¹	C
Miscellaneous Welded Connections ²	C
Miscellaneous Bolted Connections	D

F

Footnotes:

1. Groove welded full penetration splices may be increased to Category B if weld integrity is verified using non-destructive testing (NDT).
2. Miscellaneous connections include attachments for equidistant devices.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

- e. The fatigue resistance for stirrups welded to a centerbeam flange shall not be taken greater than that defined using the fatigue details defined in Section 6.6 of the AASHTO LRFD Bridge Design Specifications - Second Edition. The applicable fatigue detail for the centerbeam flange and for the stirrup shall be either a "Longitudinally Loaded Groove-Welded Attachment" or a "Longitudinally Loaded Fillet-Welded Attachment", depending upon the type of connection used.

3. Infinite Life Regime Testing

- a. The applicable constant amplitude fatigue limit (CAFL) for fatigue design may be selected as the highest CAFL of the AASHTO detail categories representing a lower bound to the experimentally acquired data. The CAFL of the AASHTO detail categories are designated in the table in Section 3.10.G.1 of this Special Provision.
- b. A unique CAFL (different from the CAFL categories delineated in Section 6.6 of the AASHTO LRFD Bridge Design Specifications - Second Edition) may be established if all ten data are within 4 ksi of that unique CAFL.

H. Data Reporting

1. Fatigue Test Results and Observations

- a. Data shall be reported in the typical S-N format (logarithm(S) vs. logarithm (N)) with the log of the stress range plotted as the ordinate (y-axis). Additionally, the data shall be reported in tabular format. The table shall contain the following information:
 - 1. Nominal stress range at the specific detail, $S_{r,eff}$
 - 2. Applied load range for each patch
 - 3. Number of cycles at initial observation of cracking (for reporting purposes only, not included as S-N data)
 - 4. Number of cycles at failure or termination of the test, N, and the reason for stopping the test (failure or termination)
 - 5. Type of crack as described in Section 3.10.F.9 of this Special Provision. A detailed description of the fatigue crack shall be provided if the observed crack does not resemble any of the crack types described in Section 3.10.F.9 of this Special Provision.

2. Miscellaneous Required Information

- a. The following information shall also be reported:
 - 1. Expansion joint system type and manufacturer
 - 2. Drawings depicting shape, size, and dimensions of the specimen

3. Drawings depicting fixture details, including specimen orientation
4. Section properties and dimensions of the centerbeam and support bar
5. Centerbeam-to-support bar connection details
 - i. Weld procedure specifications for welded expansion joint systems
 - ii. Bolt size, material specifications, location, and method of tightening for bolted expansion joint systems

3.11 Durability Testing of Elastomeric Support Bearings

A. Scope

1. This section provides guidelines for durability testing of the elastomeric support bearings typically used in modular expansion joint systems. It is not applicable to compression springs, equidistant springs, or other elastomeric components.
2. Tests shall be performed dynamically on individual bearings. Fatigue life is evaluated by applying a displacement range to each specimen rather than a load or stress range.

B. Specimens

1. Specimens shall comprise full scale bearing components representative of those installed in field applications. PTFE sliding surfaces or materials typically bonded to the elastomeric support bearings shall be fabricated as an integral part of the specimen.
2. Prior to testing, each specimen shall be visually inspected for any flaws or defects that could plausibly affect fatigue resistance. Any flaws or details shall be defined and recorded. Data obtained from specimens containing such anomalies shall not be excluded from the data set. Observed anomalies shall also be reported with the test data.

C. Test Fixtures

1. Test fixtures shall have the capability to adequately support and secure the specimen throughout the duration of the test. The fixture shall be designed and fabricated to such tolerances as required to assure that additional stresses will not be generated in the specimen as a consequence of fixture misalignment.

D. Loading Details

1. Loads shall be applied through hydraulic actuators or other similar loading devices. Fatigue testing shall be performed using displacement control. Displacement and load ranges shall be continuously monitored throughout the duration of the fatigue test to assure that desired displacement range and minimum preload are maintained.

2. Load shall be applied to the specimen through flat steel plates that are smooth and free of surface corrosion. These plates shall be sufficiently thick to assure even load distribution to the specimen.

E. Dynamic Stiffness Test

1. Testing shall be conducted on each specimen to be subjected to fatigue testing in order to establish its dynamic stiffness for at least three different loading frequencies. The maximum of these loading frequencies shall be equal to the service load frequency corresponding to a vehicle traveling at 60 mph. The loading frequency, f , shall be calculated as:

$$f \equiv 0.5 \cdot V / (g + b)$$

where

$V \equiv$ vehicle speed (60 mph at service load)

$g \equiv$ centerbeam gap (assume mid-range configuration)

$b \equiv$ centerbeam width

2. The load range applied during the dynamic stiffness test shall be that obtained from structural analysis using fatigue wheel load and wheel load distribution factors as specified in Section 3.04 and Section 3.05 of this Special Provision.
3. Each dynamic stiffness test shall be performed three times. Data from individual tests shall be compared to assure consistency of test results.

F. Fatigue Test

1. A minimum of three fatigue tests shall be required to establish the durability of each type of bearing.
2. The fatigue test shall be conducted using displacement control. The displacement (strain) range shall be applied using a sine or other smooth waveform at any frequency less than or equal to the service load frequency calculated in Section 3.11.E of this Special Provision. The magnitude of the applied displacement amplitude, Δ , shall be calculated as:

$$\Delta \equiv R_v / K$$

where

$R_v \equiv$ vertical reaction force at the support bearing as obtained from structural analysis

$K \equiv$ dynamic stiffness of the support bearing as determined in Section 3.11.E of this Special Provision

3. A minimum precompression strain shall be maintained in the specimen throughout the duration of the test. This precompression strain shall be approximately equal to that present in a support bearing in a field installation. The magnitude of the applied cyclic strain shall be at least equal to the precompression strain.
4. The minimum and maximum dynamic load shall be recorded at the beginning of the test. The minimum and maximum dynamic load shall be monitored and periodically recorded throughout the duration of the test.
5. At the end of each applied displacement cycle, the displacement shall be held at the precompression level for no less than one half of the period of loading in order to facilitate heat dissipation. Artificial air flow devices (electrical fans) may be used to assist heat dissipation. Excessive heat generation will adversely affect the tested fatigue life.
6. A specimen shall be accepted as having passed the fatigue test criteria after withstanding 2 million cycles of loading without failure.
7. The following criteria shall constitute failure:
 - a. The elastomeric material exhibits excessive deterioration or cracking.
 - b. The measured minimum dynamic load falls to 30% of the initial dynamic load recorded at test initiation.
 - c. The measured dynamic load range decreases to half of the initial dynamic load range recorded at test initiation.

G. Data Reporting for Fatigue Test

1. Data shall be reported in tabular format and shall contain the following information for each specimen tested:
 - a. Minimum (precompression) strain, maximum strain, displacement, and load at test initiation
 - b. Type of loading impulse (sine wave, ramp, etc.)
 - c. Number of cycles at initial observation of distress leading to failure (for reporting purposes only, not to be included in the data)
 - d. Number of cycles at failure
 - e. A description of the mode of failure
2. The following data shall also be reported for each specimen tested:
 - a. Bearing type and manufacturer
 - b. Drawings depicting shape, size, and dimensions of the specimen including any PTFE sliding surfaces or materials bonded to the specimen
 - c. Drawings depicting fixture details, including specimen orientation.

3.12 Testing Laboratory

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

- A. Fatigue testing shall be performed by an independent testing laboratory. The following individuals have stated that they have access to facilities capable of performing the fatigue testing:

1. Prof. Charles W. Roeder

Department of Civil Engineering
233B More Hall
University of Washington
Seattle, WA
Tel: (206) 543-6199
Fax: (206) 543-1543

2. Dr. John W. Fisher

ATLSS Research Center
Lehigh University
117 ATLSS Drive
Bethlehem, PA 18015-4793
Tel: (215) 758-3535
Fax: (215) 758-5553

3. Prof. Robert J. Dexter

Department of Civil Engineering
University of Minnesota
122 CivE
500 Pillsbury Drive S.E.
Minneapolis, MN 55455-0220
Tel: (612)-624-0063
Fax: (612)-626-7750

3.13 Fatigue Testing Reference

- A. Provisions contained in Sections 3.10 and 3.11 of this Special Provision have been developed from research summarized in National Cooperative Highway Research Program Report 402 "Fatigue Design of Modular Bridge Expansion Joints", National Academy Press, Washington DC, 1997.

3.14 General Fabrication Requirements

- A. The expansion joint systems shall be fabricated consistent with the details, dimensions, material specifications, and procedures delineated in the approved shop plans. All fabrication procedures shall be in conformance with the Standard Specifications and the Special Provisions.
- B. All expansion joint systems shall be fabricated by the same manufacturer.

- C. Metallic attachments used to secure elastomeric seals to the centerbeams, if welded to the centerbeams and edge beams, shall be welded continuously along both their top and bottom edges.

3.15 PTFE Sliding Surfaces

- A. All PTFE shall be bonded under controlled conditions and in strict accordance with written instructions provided by the PTFE manufacturer.
- B. All PTFE surfaces shall be smooth and free of bubbles after completion of bonding operations.

3.16 Stainless Steel Sliding Surfaces

- A. All stainless steel sliding surfaces in contact with PTFE shall be polished to a Number 8 mirror finish.
- B. Each stainless steel sheet shall be welded to the steel backing plate in accordance with current AWS specifications. The stainless steel sheet shall be clamped to provide full contact with the steel backing plate during welding. The welds shall not protrude above the sliding surface of the stainless steel sheet.

3.17 Corrosion Protection

- A. All steel surfaces, except those surfaces beneath stainless steel sheet, those to be bonded to PTFE, or those in direct contact with strip seals, shall be protected against corrosion by one of the following methods:
 - 1. Zinc metallized in accordance with the Special Provision METALLIC COATINGS.
 - 2. Hot-dip galvanized per AASHTO M 111.

Painted in accordance with Section 6-03.3(30) as supplemented in these Special Provisions. The color of the final coat shall be Washington Gray (revised). The surfaces embedded in concrete shall be painted only with a shop coat of inorganic zinc silicate paint.

3.18 Inspection

- A. Each expansion joint system shall be subjected to and shall pass three levels of inspection in order to be accepted. These three levels are Quality Control Inspection, Quality Assurance Inspection, and Final Inspection. The manufacturer shall provide both Quality Control Inspection and Quality Assurance Inspection. The Design-Builder shall provide access to WSDOT for the Final Inspection.
- B. *Quality Control Inspection* shall be provided by the manufacturer on a full time basis during the fabrication process of all major components to assure that the materials and workmanship meet or exceed the minimum requirements of the contract. *Quality Control Inspection* shall be performed by an entity having a line of responsibility distinctly different from that of the manufacturer's fabrication department.
- C. *Quality Assurance Inspection* shall be performed by an independent inspection agency provided by the manufacturer. *Quality Assurance Inspection* is not required to be full time inspection, but shall be performed during all phases of the manufacturing process.

- D. *Final Inspection* of each expansion joint system will be performed by WSDOT at the job site immediately prior to installation. The Design-Builder shall provide an accessible work area for this inspection. During *Final Inspection*, WSDOT will inspect each expansion joint system for proper alignment, complete bond between expansion joint strip seals and steel components, and proper steel stud placement. There shall be no bends or kinks in the steel components, except as required to follow roadway grades and as specifically detailed on the approved shop plans. Straightening of unintended bends or kinks will not be permitted. Any expansion joint system exhibiting bends or kinks, other than those shown on the approved shop plans, shall be removed from the job site and replaced with a new expansion joint system at the expense of the Design-Builder. Expansion joint strip seals not fully bonded to the steel shall be fully bonded at the expense of the Design-Builder. Studs will be visually inspected and will be struck lightly with a hammer. Any stud which does not have a complete end weld or does not emit tintinnabulation when struck lightly with a hammer shall be replaced. Any stud located more than one inch, in any direction, from the location specified on the shop plans shall be carefully removed and a new stud shall be welded in the proper location. All stud replacements shall be at the expense of the Design-Builder.

3.19 Acceptance

- A. Each expansion joint system shall pass all three levels of inspection delineated in Section 3.18 of this Special Provision to qualify for acceptance. Any expansion joint system which fails any one of the three levels of inspection shall be replaced or repaired at no expense to the Contracting Agency and to the satisfaction of WSDOT. Any proposed remedial procedures shall be submitted to WSDOT for approval before implementation.
- B. The Design-Builder shall ascertain that the manufacturer has met the fatigue resistance characterization and prequalification requirements of Sections 3.01.A and 3.02.A of this Special Provision applicable to the specific expansion joint system being installed. The Design-Builder shall be responsible for any additional costs and/or time delays associated with selection of an alternative expansion joint system incurred as a result of noncompliance with these requirements, including the failure of the manufacturer to retest revised details or material substitutions of a previously prequalified system.

3.20 Shipping and Handling

- A. The expansion joint system shall be delivered to the job site and stored in accordance with the manufacturer's approved shop plans.
- B. Lifting mechanisms, temperature adjustment devices, and temporary anchorages shall not be welded to the centerbeams or edge beams.
- C. Damage to the expansion joint system during shipping or handling shall be just cause for rejection of the expansion joint system.
- D. Damage to the corrosion protection system shall be repaired to the satisfaction of WSDOT.

3.21 Installation

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

- A. A qualified installation technician shall be present at the job site to assure proper installation of each expansion joint system. This technician shall be a full time employee of the manufacturer of the specific expansion joint system being installed. The Design-Builder shall comply with all recommendations made by the expansion joint manufacturer's installation technician as approved by WSDOT. Each expansion joint system manufacturer's installation technician shall certify to WSDOT that the approved installation procedures were followed. All certifications to WSDOT shall be in writing and shall be signed and dated by the manufacturer's installation technician.
- B. Each expansion joint system shall be installed in strict accordance with the manufacturer's approved shop plans as stipulated in Section 3.02.B.1 of this Special Provision and the recommendations of the manufacturer's installation technician. All centerbeam welded field splices shall be performed by a certified welder under the direct supervision of the manufacturer's qualified installation technician specified in Section 3.21.A of this Special Provision. The weld procedure shall have been submitted by the manufacturer and approved in accordance with Section 3.02.B.1.i of this Special Provision. The welder shall have been trained and certified for performing those approved specific welds in accordance with the current AASHTO/AWS D1.5 Bridge Welding Code.
- C. Each permanently installed expansion joint system shall match exactly the finished roadway profile and grades.
- D. The Design-Builder shall exercise care at all times to protect each expansion joint system from damage. The Design-Builder shall protect concrete blockouts and supporting systems from damage and construction traffic prior to installation of the expansion joint systems. After installation, construction loads shall not be allowed on the expansion joint systems. The Design-Builder shall submit to WSDOT for approval a proposed method of bridging over each expansion joint system to accommodate any construction traffic.
- E. Each expansion joint system shall be set to a gap width corresponding to the ambient temperature at the time of setting. This information is specified in the Plans and shall also be specified on the approved shop plans. Any mechanical devices supplied by the joint system manufacturer, for the purpose of setting the expansion joint system to the proper gap width, will remain the property of the manufacturer. When no longer required, the devices shall be returned to the manufacturer.
- F. All forms and debris that may impede movement of the expansion joint systems shall be removed.
- G. Each expansion joint system shall be tested for watertightness after installation. The Design-Builder shall flood each completely installed expansion joint system with water to a minimum depth of 3 inches for a duration of at least one hour. If leakage is observed, the expansion joint system shall be repaired to the satisfaction of WSDOT at the Design-Builder's expense. The repair procedure shall be prepared by the expansion joint system manufacturer and shall be submitted to WSDOT for approval. After repairs are completed, the expansion joint shall be retested for leakage.

6-02, CONCRETE STRUCTURES

Materials

Section 6-02.2 is supplemented with the following:

Resin Bonded Anchors

The resin bonded anchor system shall include the nut, washer, and threaded anchor rod which is installed into hardened concrete with a resin bonding material. The resin bonded anchor system shall conform to the following requirements:

1. Threaded Anchor Rod and Nuts

Threaded anchor rods shall conform to ASTM A 193 Grade B7 or ASTM A 449, except as otherwise noted, and be fully threaded. Threaded anchor rods for stainless steel resin bonded anchor systems shall conform to ASTM F 593 and shall be Type 304 unless otherwise specified.

Nuts shall conform to AASHTO M 291, Grade DH, except as otherwise noted. Nuts for stainless steel resin bonded anchor systems shall conform to ASTM F 594 and shall be Type 304 unless otherwise specified.

Washers shall conform to AASHTO M 293, except as otherwise noted. Washers for stainless steel resin bonded anchor systems shall conform to ANSI B18.22.1 and shall be Type 304 Stainless Steel unless otherwise specified.

Nuts and threaded anchor rods, except those manufactured of stainless steel, shall be galvanized in accordance with AASHTO M 232. Galvanized threaded anchor rods shall be tested for embrittlement after galvanizing, in accordance with Section 9-06.5(4).

Threaded anchor rods used with resin capsules shall have the tip of the rod chiseled in accordance with the resin capsule manufacturer's recommendations. Galvanized threaded rods shall have the tip chiseled prior to galvanizing.

2. Resin Bonding Material

Resin bonding material shall be one of the following:

- a. Vinylester resin.
- b. Polyester resin.
- c. Methacrylate resin.
- d. A two component epoxy resin which meets the requirements of ASTM C 881, Type IV. The grade and class of the epoxy resin shall be as recommended by the epoxy resin manufacturer and as approved by WSDOT.

3. Ultimate Anchor Tensile Capacity

Resin bonded anchors shall each have the following minimum ultimate tensile load capacity when installed in concrete having a maximum compressive strength of 6000 pounds per square inch (psi) at the embedment specified below:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Anchor	Tensile	Embedment
Diameter (inch)	Capacity (lbs.)	(inch)
3/8	7,800	3-3/8
1/2	12,400	4-1/2
5/8	19,000	5-5/8
3/4	27,200	6-3/4
7/8	32,000	7-7/8
1	41,000	9
1-1/4	70,000	11-1/4

Epoxy Bonding Agent For Surfaces And For Steel Reinforcing Bar Dowels

Epoxy bonding agent for surfaces shall be Type II, as specified in Section 9-26.1. Epoxy bonding agent for steel reinforcing bar dowels shall be either Type I or Type IV, as specified in Section 9-26.1. The grade and class of epoxy bonding agent shall be as recommended by the resin manufacturer and approved by WSDOT.

Polyester Concrete

Polyester Resin Binder

The resin shall be an unsaturated isophthalic polyester-styrene co-polymer, and shall conform to the following requirements:

Viscosity: 75 to 200 cps (20 rpm at 77F) ASTM D 2196

Specific Gravity: 1.05 to 1.10 at 77F ASTM D 1475

Elongation: 35% minimum ASTM D 638

Tensile Strength: 2,500 psi minimum ASTM D 638

Conditioning: 18 hours/77F/50% + 5 hours/158F ASTM D 618

Styrene Content: 45% to 50% by weight ASTM D2369

Silane Coupler: 1.0% minimum (by weight of polyester-styrene resin)

The silane coupler shall be an organosilane ester, gammamethacryloxypropyltrimethoxysilane. The promoter/hardeners shall be compatible with suitable methyl ethyl ketone peroxide (MEKP) and cumene hydroperoxide (CHP) initiators. MEKP initiators shall be used when the surrounding concrete temperatures are above 60F. A blend of initiators may be used as approved by the Engineer when the surrounding concrete temperature is 50F to 60F.

Polyester resin binder will be accepted based on submittal to the Engineer of a Manufacturer's Certificate of Compliance conforming to Section 1-06.3.

High Molecular Weight Methacrylate (HMWM) Resin

In addition to the viscosity and density properties, and the promoter/initiator system, specified in Section 6-09.2, the HMWM resin for polyester concrete shall conform to the following requirements:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Flash Point: 180F minimum ASTM D 93

Tack-Free Time: 400 minutes maximum California Test 551

Prior to adding initiator, the HMWM resin shall have a maximum volatile content of 30 percent, when tested in conformance with ASTM D 2369.

HMWM resin will be accepted based on submittal to the Engineer of a Manufacturer's Certificate of Compliance conforming to Section 1-06.3.

Aggregate

The aggregate shall be from a WSDOT approved pit site and shall be thoroughly washed and kiln dried.

The aggregate shall conform to Section 9-03.1, and one of the following combined aggregate gradings:

Combined Aggregate

	1/2" Max.	3/8" Max.
Sieve Size	% Passing	% Passing
1/2"	100	100
3/8"	83-100	100
U.S. No. 4	65-82	62-85
U.S. No. 8	45-64	45-67
U.S. No. 16	27-48	29-50
U.S. No. 30	12-30	16-36
U.S. No. 50	6-17	5-20
U.S. No. 100	0-7	0-7
U.S. No. 200	0-3	0-3

Aggregate retained on the U.S. No. 8 sieve shall have a maximum of 25 percent crushed particles. Fine aggregate shall consist of natural sand only.

Aggregate absorption shall not exceed one percent. The moisture content of the aggregate shall not exceed one half of the aggregate absorption at the time of mixing with the polyester resin binder. The aggregate temperature shall be between 45F and 100F at the time of mixing.

Sand for Abrasive Finish

The sand for abrasive finish shall conform to Section 6-09.2, and the aggregate moisture content requirements specified above.

Masonry Materials

Concrete Masonry Units

Concrete masonry units (CMU) shall conform to ASTM C 90, Grade N, Type 1, with a density between 100 and 115 pounds per cubic foot. Shrinkage shall not exceed 0.065 percent.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

11 CMU's shall contain a water repellent admixture in accordance with the admixture manufacturer's recommendations. The water repellent admixture shall be "Dry-Block System" by W. R. Grace Company, or an approved equal.

All CMU's shall be standard manufactured units with nominal face dimensions of eight inches high and 1'-4" long. The CMU block thickness shall be eight inches, unless otherwise shown in the Plans. Special shapes shall be provided to complete the work as shown in the Plans.

CMU surface texture and color shall meet the requirements of the *I-405 Urban Design Criteria for Kirkland Stage I*.

All CMU's shall be of uniform texture and color, obtained from one source. The Contractor shall submit four samples of each type of CMU block specified for use on the project to the Engineer for approval.

The Contractor shall submit a certificate of compliance from the CMU manufacturer to the Engineer, in accordance with Section 1-06.3, certifying compliance with the specified requirements. The submittal shall include test results as required from tests conducted within the previous twelve months.

CMU Grout

CMU grout shall conform to ASTM C 476, with a six sack minimum mix and 3/8 inch aggregate. The CMU grout shall have a minimum 28 day compressive strength of 1,800 psi and a slump of ten inches.

Mortar

Portland cement shall be Type 1 conforming to Section 9-01.2(1).

Masonry cement shall conform to ASTM C 91.

Aggregate shall conform to AASHTO M 45.

Hydrated lime shall conform to ASTM C 207.

Water shall conform to Section 9-25.1.

The mortar shall conform to ASTM C 270, Type S, and shall be mixed in accordance with one of the following mix proportions:

Alt. 1 Alt. 2

Portland Cement	1 part	1/2 part
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Masonry Cement - 1 part

Hydrated Lime 1/4 to 1/2 part -

Aggregate 4-1/2 parts 4-1/2 parts

The proportions of damp, loose aggregate for both alternative mixes shall be not less than 2-1/4 times nor greater than 3 times the sum of the volumes of cement and lime used.

The minimum compressive strength at 28 days shall be 1,800 psi.

The mortar mixture shall include a water repellent integral admixture, mixed in accordance with the admixture manufacturer's recommendations. The water repellent integral admixture shall be "Dry-Block System" by W. R. Grace Company, or an approved equal.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

To ensure uniform color, texture, and quality, all mortar mix components shall be obtained from one manufacturer for each component, and from one source and producer for each aggregate.

Parge Coating

The parge coating applied to the top of the assembled CMU wall shall be one of the following waterproof cement base coatings:

1. Thoroseal, manufactured by Thoro.
2. Fabriseal, manufactured by Fabrikem.
3. Tamoseal, manufactured by Tamms.

Strip Seal Expansion Joint System

The metal components shall conform to ASTM A 36, ASTM A 992, or ASTM A 572, and shall be protected against corrosion by one of the following methods:

1. Zinc metallized in accordance with the Special Provision METALLIC COATINGS.
2. Hot-dip galvanized in accordance with AASHTO M 111.
3. Paint in accordance with Section 6-07.3(1). The color of the final coat shall be Washington Gray. The surfaces embedded in concrete shall be painted only with a shop coat of inorganic zinc silicate paint.

The strip seal gland shall be continuous for the full length of the joint with no splices permitted, unless otherwise shown in the Plans.

Compression Seal Expansion Joint System

Compression seal glands shall be selected from the approved products listed in the WSDOT Qualified Products List, latest edition, and sized as appropriate for the compression seal expansion joints shown in the Plans.

Rapid Cure Silicone Sealant

Rapid cure silicone sealant shall be one of the following two products conforming to the following specifications:

Dow Corning 902 RCS Joint Sealant

The joint sealant shall be a rapid cure, 100 percent silicone, low modulus, self-leveling, cold applied, two part formulation, which is compatible with the surfaces to which it is applied. Rapid cure is defined as developing sufficient integrity within eight hours to accommodate both horizontal thermal movements and vertical movements at the joint.

The joint sealant shall not be an acid cure sealant.

The joint sealant shall conform to the following properties:

As Applied

Extrusion rate	MIL S 8802	7 to 19.4 ounces/minute
Specific gravity	ASTM D 1475	1.25 to 1.35
Nonvolatile content		93 percent minimum

As Installed

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
(at 77F, 50 percent relative humidity, and 48 hours cure)

Skin-over time		20 minutes maximum
Joint elongation	ASTM D 5329*	600 percent minimum
Joint modulus	ASTM D 5329*	3 to 12 psi at 100% elongation

*Section 14 modified as follows:

Pull Rate = two inches/minute

Specimen joint size = 0.5 inches by 0.5 inches by 2 inches

The primer shall be as recommended by the sealant manufacturer.

Watson Bowman Acme Two Part Silicone Sealant

The joint sealant shall be a cold applied, low modulus, two part formulation. When properly mixed, the joint sealant shall cure within four hours to form a well bonded seal.

The joint sealant shall conform to the following properties:

As Supplied (Each Component)

Extrusion rate	ASTM C 1183	12 to 37 cubic inches/minute
Leveling	ASTM C 639	Self leveling

As Installed

Tack free time	ASTM C 679	60 minutes maximum
Joint elongation	ASTM D 5329 ^{1, 2}	600 percent minimum
Joint modulus (min.)	ASTM D 5329 ^{1, 2}	15 psi at 100% elongation
Cure Evaluation	ASTM D 5893	Pass at four hours maximum
Ultimate elongation	ASTM D 412 Die C ¹	1,000 percent minimum
Ult. stress (max.)	ASTM D 412 Die C ¹	25 psi at 150% elongation
Shore Hardness, 00	ASTM C 661 ¹	40 - 80
Specific Gravity	ASTM D 792 ¹	1.20 - 1.40

¹ Seven day cure at 77F±3F and 50±5 percent relative humidity

² Specimen joint size = 0.5 inches by 0.5 inches by 2 inches

The Contractor shall deliver the joint sealant to the job site in the sealant manufacturer's original sealed container. Each container shall be marked with the sealant manufacturer's name and lot or batch number. Each lot or batch shall be accompanied by the manufacturer's Materials Safety Data Sheet (MSDS), and Certificate of Compliance, identifying the sealant manufacturer and the lot or

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
batch number, and certifying that the materials conform to the specified requirements.

The backer rod shall be closed cell expanded polyethylene foam as recommended by the sealant manufacturer and approved by the Engineer. The diameter of the backer rod shall be as recommended by the sealant manufacturer for the expansion joint opening at the time of installation.

Fabric Pad Bearing

Pre-formed Fabric Pads

Pre-formed fabric pads shall be composed of multiple layers of duck, impregnated and bound with high quality oil resistant synthetic rubber, compressed into resilient pads of uniform thickness. The duck shall be of highest quality cotton or cotton-polyester 50-50 blend, and shall weigh a minimum of eight ounces per square yard. The cotton warp and the filling yarn shall be 2-ply. The cotton-polyester warp and fill shall be single yarn, with a minimum breaking strength by grab method of 150 pounds per inch per width (piw) warp, and 140 piw fill. The filling count of the duck shall be 40 ± 2 threads per inch and the warp count shall be 50 ± 1 threads per inch. The number of piles shall be sufficient produce the specified thickness, after compression and vulcanizing.

The finished pads shall withstand compression loads perpendicular to the plane of the laminations of not less than 10,000 psi without any sign of failure after the load is removed. Failure is defined as any breakdown of the component materials or laminations.

The pre-formed fabric pad shall have a shore A hardness of 90 ± 5 .

Polytetrafluorethylene (PTFE) Sheet

PTFE self-lubricating bearing sheet shall be 1/8 inch thick unless otherwise noted in the Plans. PTFE sheet shall be composed of 100 percent virgin (unfilled) polytetrafluorethylene polymer except where filled PTFE is specified in the Plans. PTFE sheet shall be recessed and bonded to a depth of one half the PTFE sheet thickness into the steel backing plate. The exposed height of the PTFE shall not be less than 3/64 inch. The substrate shall limit the flow (elongation) of the confined PTFE to not more than 0.009 inch under a pressure of 2,000 psi for 15 minutes at 78F for a two inch by three inch test sample. Dimpled PTFE, if shown in the Plans, shall be unfilled and have a minimum thickness of 3/16 inch. Dimples shall be placed in a 1/2 inch grid and shall have a depth of 1/16 inch.

Unfilled PTFE shall conform to the following requirements:

Requirement	Test Methods	Value
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Hardness at 78F	ASTM D 2240	50-65 Durometer D
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Tensile Strength, psi	ASTM D 1457	2,800 (Min. Avg.)
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Elongation %	ASTM D 1457	200 (Min. Avg.)
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Specific Gravity	ASTM D 792	2.14 to 2.21
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Filled PTFE sheet shall be made from virgin PTFE resin uniformly blended with inert filler material (15% glass fiber). Filled PTFE shall conform to the following requirements:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Requirement	Test Methods	Value
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Tensile Strength, psi	ASTM D 1457	2,200 (Min. Avg.)
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Elongation %	ASTM D 1457	150% (Min. Avg.)
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Specific Gravity	ASTM D 792	2.2
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Melting Point	ASTM D 1457	620F ± 18F
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Stainless Steel Sheet

Stainless steel sheet shall be no less than 14 gage meeting ASTM A 240 Type 304L specifications. Stainless steel in contact with the PTFE shall be polished to a Number 8 mirror finish.

Structural Carbon Steel

Sole plates and steel backing plates, and masonry plates if shown in the Plans, shall conform to ASTM A 36 and the dimensions shall conform to the details shown in the Plans. The surface of the recess of the steel backing plate shall have an average surface roughness of 250 microinches. The surface of the sole plate in contact with the stainless steel sheet shall have an average surface roughness of 125 microinches.

Welded Shear Connectors

Welded shear connectors shall conform to Section 9-06.15.

Bolts and Washers

Bolts and washers shall conform to Section 9-06.5(3), and shall be galvanized after fabrication in accordance with AASHTO M 232.

Anchor Bolts, Nuts and Washers

Anchor bolts, nuts and washers, if shown in the Plans, shall conform to Section 9-06.5(4). The top 1'-0" of the exposed end of the anchor bolts, and the associated nuts and washers, shall be galvanized after fabrication in accordance with AASHTO M 232.

Concrete Inserts

Concrete inserts shall be as specified in the Plans.

Silicone Grease and Epoxy Gel

Silicone grease shall conform to Military Specification MIL-S-8660.

Epoxy gel shall conform to the requirements of Section 9-26.1, Type I, Grade 3, Class A, B, or C.

Submittals of Test Reports, Certifications, and Samples

The Contractor shall submit to the Engineer the following test reports, certifications, and samples for review, testing and approval, prior to installing the fabric pad bearings:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

1. Manufacturer's certificate of compliance for the polytetrafluorethylene (PTFE) sheeting, fabric, and elastomer, the pre-formed fabric pad duck, the silicone grease, and the epoxy gel.
2. Certified mill test reports for all steel and stainless steel in the bearing assemblies.
3. Certified test reports confirming that the pre-formed fabric pads meet the specified requirements of proof load.
4. Samples of the pre-formed fabric pads, size six inches by six inches by one inch, and PTFE sheet, size two inches by three inches by 1/8 inch, from the production material.

The Engineer will require 15 calendar days to review and test the submitted certificates, test reports, and samples. If all or a portion of the submittal fail to meet the specified requirements, the Contractor shall correct the deficiencies and resubmit to the Engineer. An additional 15 calendar days may be required by the Engineer for review of each resubmittal.

High-Load Elastomeric Bearing Pad Assembly

High-load elastomeric bearing pads shall meet all Level I and Level II acceptance criteria as specified in AASHTO M 251.

The Contractor shall perform a Long Duration Compression Load test on high-load elastomeric bearing pads randomly selected from each size and material batch of the production bearings. The Contractor shall test one bearing per lot, minimum, where one lot is defined as ten percent of the total number of production bearings in each size and material batch. The Long Duration Compression Load test shall be as specified in Sections 18.7.2.6 and 18.7.4.5.7, Division II Construction, of the AASHTO Standard Specifications for Highway Bridges, Sixteenth Edition and latest interims. The Contractor shall submit the test results to the Engineer for approval.

If one of the test bearings fails, all of the bearings of that lot shall be rejected, unless the Contractor elects to test each bearing of the lot, at no additional expense to the Contracting Agency. In lieu of this procedure, the Engineer may require the Contractor to test all bearings of the lot.

Steel bars, plates, and shapes, shall conform to ASTM A 36.

Silicon grease shall conform to Military Specification MIL-S-8660.

Epoxy gel shall conform to Section 9-26.1, Type I, Grade 3, Class A, B, or C.

Bolts shall conform to Section 9-06.5(3).

Bridge Supported Utilities

Inserts shall be of the type and model specified in the Plans. Inserts shall be galvanized in accordance with AASHTO M 111.

Hanger rods, and associated nuts and washers, shall conform to Section 9-06.5(1), and shall be galvanized in accordance with AASHTO M 232.

Steel bars and plates shall conform to ASTM A 36 and shall be galvanized in accordance with AASHTO M 111.

Horizontal strut bolts, and associated nuts and washers, shall conform to Section 9-06.5(3), and shall be galvanized in accordance with AASHTO M 232.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Pre-formed fabric pads shall be composed of multiple layers of duck, impregnated and bound with high quality oil resistant synthetic rubber, compressed into resilient pads of uniform thickness. The duck shall be of highest quality cotton or cotton-polyester 50-50 blend, and shall weigh a minimum of eight ounces per square yard. The cotton warp and the filling yarn shall be 2-ply. The cotton-polyester warp and fill shall be single yarn, with a minimum breaking strength by grab method of 150 pounds per inch per width (piw) warp, and 140 piw fill. The filling count of the duck shall be 40 ± 2 threads per inch and the warp count shall be 50 ± 1 threads per inch. The number of piles shall be sufficient to produce the specified thickness, after compression and vulcanizing.

The finished pads shall withstand compression loads perpendicular to the plane of the laminations of not less than 10,000 psi without any sign of failure after the load is removed. Failure is defined as any breakdown of the component materials or laminations.

Pre-formed fabric pads shall have a shore A hardness of 90 ± 5 .

Pre-formed fabric pads for bridge utility supports will be accepted based on the manufacturer's certificate of compliance that the material furnished conforms to these specifications. The Contractor shall submit the manufacturer's certificate of compliance to the Engineer in accordance with Section 1-06.3.

Pipe rolls or pipe saddles shall be of the type and model specified in the Plans.

Anchor straps shall conform to ASTM A 36 and shall be galvanized after fabrication in accordance with AASHTO M 111.

Anchor bolts, and associated nuts and washers, shall conform to Section 9-06.5(3), and shall be galvanized in accordance with AASHTO M 232.

Resin Filler

Resin filler shall be a two component, resin and catalyst, liquid thermoset material.

The properties of the resin and catalyst shall be:

1. The components shall be supplied in separate containers.
2. The viscosity of the resin-catalyst mixture shall be $35,000 \square 5,000$ CPS at 75F immediately after mixing.
3. The flash point shall be 100F minimum.
4. After mixing, the resin-catalyst mixture shall be pourable for a minimum of eight minutes at 60F and shall harden in fifteen minutes maximum. Heating of the mixture after placing to a maximum temperature of 250F is permissible to obtain a full cure.

The properties of the cured resin shall be:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

1. The fully cured compressive strength shall be 12,000 psi minimum.
2. The maximum allowable shrinkage shall be 2 percent. To control shrinkage, an inert filler may be used in the resin provided that the viscosity requirements are met.
3. The hardness shall be between 40 and 55 in accordance with ASTM D 2583.

A resin material known to meet the specified requirements herein is used in the wire rope industry for resin socketing.

The Contractor shall submit a Manufacturer's Certificate of Compliance in accordance with Section 1-06.3 to the Engineer for approval prior to using the resin filler.

Compression Molded Pad

The compression molded pad shall be of the size and shape shown in the Plans.

The molded bearing pad shall be composed of a compression molded resilient pad of uniform thickness composed of milled rubber and fiber. The rubber shall be natural or synthetic blends. The fiber shall be randomly dispersed to an average content of 40 percent by volume and the maximum fiber length shall be 1-1/2 inches.

The finished pads shall withstand compression loads perpendicular to the plane of the pad of not less than 8,000 psi without any sign of failure after the load is removed. Failure is defined as any breakdown of the component materials or separation of the component materials.

The durometer hardness (shore A) of the finished pads shall be 87 ± 5 .

The flexibility of the material shall be such that a sample 1/4 inch thick from the same lot as producing the pads shall show no cracks when bent around a 3/4 inch mandrel.

A sample from the lot producing the pads shall exhibit no more than 10 percent change in hardness after heat aging at 158F for 70 hours.

The manufacturer shall certify to the Engineer in writing prior to installation of the pads, that both the flexibility and change in hardness requirements are met.

Bridge Grate Inlet

Steel in grates, angles, and anchors for bridge grate inlets shall conform to Section 9-05.16.

Pipe straps shall conform to ASTM A 36, and shall be galvanized after fabrication in accordance with AASHTO M 111.

Anchor bolts and associated nuts and washers shall conform to Section 9-06.5(1) and shall be galvanized after fabrication in accordance with AASHTO M 232.

Drain pipe stub shall conform to the Section 9-05.1(2) requirements for zinc coated (galvanized) corrugated steel drain pipe.

Elastomeric expansion joint seal glands shall be selected from the approved products listed in the WSDOT Qualified Products List, latest edition, and sized as appropriate for the bridge grate inlet expansion joint shown in the Plans.

Bridge Drain Risers

Spacer bars and riser bars for the drain riser assembly shall conform to ASTM A 36.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
Prestressed Concrete Girders

Aggregates and Proportioning

The second paragraph of Section 9-19.1 is revised to read as follows:

The Contractor shall submit a Contractor-Provided mix design for each design strength of prestressed girder to the Engineer for approval in accordance with Section 6-02.3(2)A, including a Contractor-Provided mix design of high strength concrete for the prestressed girders of *** WSDOT Bridge No. 405/55E and No. 405/55W (if prestressed girders are used ***.

Approval of the mix design will not preclude any requirements for the concrete placed in the girders.

The Contractor-Provided mix design for high strength concrete shall conform to the minimum compressive strength in psi at 56 days as specified in the design calculations and in accordance with AASHTO T 22.

The Contractor may substitute testing for minimum compressive strength at 28 days, provided that the 28 day compressive strength is equal to or greater than 95 percent of the specified 56 day compressive strength.

The Contractor shall test a minimum of three specimens for each of the tests specified. The test specimens for the compressive strength tests shall be four inch by eight inch cylinders cast in molds supplied by the Contractor in accordance with Section 6-02.3(5)D. The Contractor shall include the results of all tests in the high strength concrete mix design submittal to the Engineer.

Construction Requirements

Section 6-02.3 is supplemented with the following:

Polyester Concrete

Mix Design

Polyester concrete shall be composed of the following three components – polyester resin binder, high molecular weight methacrylate (HMWM) resin, and aggregate, in accordance with Section 6-02.2 as supplemented in these Special Provisions.

The Contractor shall prepare and submit the polyester concrete design mix and mixing procedure, including samples of all components for each lot, to the WSDOT Materials Laboratory for testing. The mix design shall include a recommended initiator percentage for the expected application temperature. The Contractor shall not begin ordering materials for application of the polyester concrete until receiving the Engineer's approval of the polyester concrete design mix and mixing procedure.

Delivery and Storage of Materials

All materials shall be delivered in their original containers bearing the manufacturer's label, specifying date of manufacturing, batch number, trade name brand, and quantity. Each shipment of polyester resin binder and HMWM resin shall be accompanied by a Materials Safety Data Sheet (MSDS).

The material shall be stored to prevent damage by the elements and to ensure the preservation of their quality and fitness for the work. The storage space shall be

kept clean and dry, and shall contain a high-low thermometer. The temperatures of the storage space shall not fall below nor rise above that recommended by the manufacturer. Every precaution shall be taken to avoid contact with flame.

Stored materials shall be inspected prior to their use, and shall meet the requirements of these Special Provisions at the time of use.

Any material which is rejected because of failure to meet the required tests or that has been damaged so as to cause rejections shall be immediately replaced at no additional expense to the Contracting Agency.

Sufficient material to perform the entire polyester concrete application shall be in storage at the site prior to any field preparation, so that there shall be no delay in procuring the materials for each day's application.

Material Health and Safety Training and Precautions

The Contractor shall arrange to have the material supplier furnish technical service relating to application of material and health and safety training for personnel who are to handle the polyester concrete and the HMWM resin prime coat.

Appropriate impermeable protective garments shall be used by all workers who may contact the resin or initiators to prevent skin contact. If skin contact occurs, the resin or initiators shall be immediately washed off. Clothing that becomes saturated with resin shall be removed immediately.

Equipment and Containment

All equipment for cleaning the concrete and steel surfaces, and mixing and applying the polyester concrete, shall be submitted to the Engineer for approval.

The HMWM resin, and abrasive blasting materials, shall be contained and restricted to the surface receiving the polyester concrete only, and shall not escape to the surrounding environment. The Contractor shall submit the method and materials used to collect and contain the HMWM resin, and abrasive blasting materials, to the Engineer for approval.

The Contractor shall not begin polyester concrete work, including surface preparation, until receiving the Engineer's approval of the equipment, and the collection and containment system.

Surface Preparation

Using the equipment, material, technique, and procedures established for surface preparation, the concrete and steel surfaces shall be prepared by removing all material which may act as a bond breaker between the surface and the polyester concrete. Surface cleaning shall be by abrasive blasting.

Precautions shall be taken to ensure that no dust or debris leaves the roadway deck and that all traffic is protected from rebound and dust. Appropriate shielding shall be provided as required at no additional expense to the Contracting Agency and shall be as approved by the Engineer.

If the concrete or steel surfaces become contaminated, the contaminated areas shall be recleaned by abrasive blasting at no additional expense to the Contracting Agency.

Application of Prime Coat

Application of the HMWM prime coat and the polyester concrete shall not begin if rain is expected. The area receiving the prime coat shall be dry and had no rain within the past 12 hours. Immediately prior to applying the prime coat, the surfaces shall be swept clean by compressed air to remove accumulated dust and any other loose material.

The concrete bridge deck surface shall be between 50F and 100F when applying the prime coat.

The Contractor shall apply one coat of promoted/initiated wax-free HMWM resin to the prepared concrete and steel surfaces immediately before placing the polymer concrete. The promoted/initiated resin shall be worked into the concrete in a manner to assure complete coverage of the area receiving polyester concrete. A one pint sample of each batch of promoted/initiated HMWM resin shall be retained and submitted to the Engineer at the time of primer application to verify proper catalyzation.

The prime coat shall cure for 30 minutes minimum before beginning placement of the polyester concrete. Placement of the polymer concrete shall not proceed until the Engineer verifies that the HMWM resin was properly promoted and initiated, as evidenced by the HMWM batch sample.

If the primed surface becomes contaminated, the contaminated area shall be cleaned by abrasive blasting and reprimed at no additional expense to the Contracting Agency.

Under no circumstances shall any resin run into drains or expansion joints, or otherwise escape the Contractor's collection and containment system.

Mixing Equipment for Polyester Concrete

Polyester concrete shall be mixed in mechanically operated mixers in accordance with the mix design as approved by the Engineer. The mixer size shall be limited to a nine cubic yard maximum capacity, unless otherwise approved by the Engineer.

The aggregate and resin volumes shall be recorded for each batch along with the date of each recording. A printout of the recordings shall be furnished to the Engineer at the end of each work shift.

The Contractor shall prevent any cleaning chemicals from reaching the polyester mix during the mixing operations.

Mixing Components

The polyester resin binder in the polyester modified concrete shall be approximately 12 percent by weight of the dry aggregate. The Contractor shall determine the exact percentage as approved by the Engineer.

The amount of peroxide initiator used shall result in a polyester concrete set time between 30 and 120 minutes during placement as determined by California Test 551, Part 2, "Method of Test For Determination of Set Time of Concrete Overlay and Patching Materials", by Gilmore Needles. Accelerators or inhibitors may be required as recommended by the polyester resin binder supplier and as approved by the Engineer.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

The polyester resin binder shall be initiated and thoroughly blended just prior to mixing the aggregate and binder. The polyester concrete shall be thoroughly mixed prior to placing.

Polyester Concrete Placement

The polyester concrete shall be placed on the liquid or hardened prime coat within two hours of placing the prime coat.

Polyester concrete shall be placed prior to gelling and within 15 minutes following initiation, whichever occurs first. Polyester concrete that is not placed within this time shall be discarded.

The surface temperature of the area receiving the polyester concrete shall be the same as specified above for the HMWM prime coat.

Under no circumstances shall any polyester mixture run into drains or expansion joints, or otherwise escape the Contractor's collection and containment system.

The polyester concrete shall be consolidated to a relative compaction of not less than 97 percent.

Finished Polyester Concrete Surface

The finished surface of the polyester concrete shall conform to the requirements of Section 6-02.3(10).

The polyester concrete shall be consolidated by means approved by the Engineer. Finishing equipment used shall strike off the polyester concrete to the established grade and cross section. Forms shall be coated with suitable bond release agent to permit ready release of forms.

The polyester concrete shall receive an abrasive sand finish. The sand finish shall be applied by hand immediately after strike-off and before gelling occurs. Sand shall be broadcast onto the surface to affect a uniform coverage of a minimum of 0.8 pounds per square yard.

The surface texture of polyester concrete surface shall be uniform. The polyester concrete shall be impervious to moisture.

Curing

Traffic and equipment shall not be permitted on the polyester concrete until it has achieved a minimum compressive strength of 2,500 psi as determined by the rebound number per ASTM C 805.

Areas of the polyester concrete that do not totally cure or that fail to attain the specified minimum compressive strength in six hours shall be removed and replaced by the Contractor at no additional expense to the Contracting Agency.

Proportioning Materials

Section 6-02.3(2) is supplemented with the following:

Expansion Joint Header Concrete

Expansion joint header concrete shall have a minimum compressive strength of 2,500 psi at 12 hours, and 4,000 psi at 28 days.

The maximum water-cement ratio shall be 0.40. The minimum fly ash content shall be ten percent of the total cementitious materials.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Type III cement conforming to Section 9-01.2(1) may be used, provided the content of tricalcium aluminate (C_3A) shall not exceed 8 percent by weight calculated as $2.650Al_2O_3$ minus $1.692Fe_2O_3$.

Combined aggregate, with a maximum aggregate size of 5/8 inch, shall conform to Section 9-03.1(5).

Section 6-02.3(3) notwithstanding, non-chloride accelerating admixtures conforming to Section 9-23.6 and the following specifications may be used:

Admixture Specifications

Accelerating Type C	AASHTO M 194 Type C	ASTM C 494
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Water Reducing/

Accelerating Type E	AASHTO M 194 Type E	ASTM C 494
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Roadway Slabs

Section 6-02.3(10) is supplemented with the following:

Bridge Drain Risers

The Contractor shall submit the method of removing the bridge drain grate nipple extrusion, the method of grinding the existing curb as necessary for bridge drain riser installation, and the method of cleaning the existing drain casting surfaces in contact with the drain risers, to the Engineer for approval. The shop drawings and weld procedures for the drain riser assemblies shall be submitted to the Engineer in accordance with Sections 6-03.3(7) and 6-03.3(25).

The existing bridge drain grate bolt, debris from removing the nipple extrusion and cleaning the drain casting contact surfaces, and all debris in the bridge drain cavity, shall be disposed of in accordance with Section 2-02.3.

After cleaning the bridge drain casting contact surfaces, the Contractor shall install the spacer bars and riser bars of the bridge drain riser assembly as shown in the Plans.

All exposed surfaces of the spacer bars and riser bars following installation shall be painted with two coats of Formula A-11-99 Primer as specified in Section 9-08.2. Each coat shall have a minimum dry film thickness of two mils.

Expansion Joints

Section 6-02.3(13) is supplemented with the following:

Strip Seal Expansion Joint System

The Contractor shall submit working drawings of the expansion joint system to the Engineer for approval in accordance with Section 6-03.3(7). These plans shall include but not be limited to the following:

1. Plan, elevation, and sections of the joint system and all components, with dimensions and tolerances.
2. All material designations.
3. Manufacturer's written installation procedure.
4. Corrosion protection system used on the metal components.
5. Locations of welded shear studs, lifting mechanisms, temperature setting devices, and construction adjustment devices.
6. Method of sealing the system to prevent leakage of water through the joint.

The strip seal shall be removable and replaceable.

Other than items shown in the Plans, threaded studs used for construction adjustments are the only items that may be welded to the steel shapes provided they are removed by grinding after use, and the area repaired by application of an approved corrosion protection system.

If the opening between the steel shapes is anticipated to be less than 1-1/2 inches at the time of seal installation, the seal may be installed prior to encasement of the steel shapes in concrete.

After the joint system is installed, the joint shall be flooded with water and inspected, from below the joint, for leakage. If leakage is observed, the joint system shall be repaired by the Contractor, as recommended by the manufacturer and approved by the Engineer, at no additional cost to the Contracting Agency.

Compression Seal Expansion Joint System

The compression seal expansion joint system shall be installed in accordance with the manufacturer's written recommendations. The Contractor shall submit the manufacturer's written installation procedure to the Engineer prior to installing the expansion joint system.

After the joint system is installed, the joint area shall be flooded with water and inspected, from below the joint, for leakage. If leakage is observed, the joint system shall be repaired by the Contractor, as recommended by the manufacturer and approved by the Engineer, at no additional cost to the Contracting Agency.

Falsework and Formwork

Concrete Forms on Steel Spans

The first paragraph of Section 6-02.3(17)K is revised to read as follows:

Except as otherwise specified, concrete forms on all steel structures shall be removable and shall not remain in place. Where needed, the forms shall have openings for truss or girder members. Each opening shall be large enough to leave at least 1-1/2 inches between the concrete and steel on all sides of the steel member after the forms have been removed. Unit contract prices cover all costs related to these openings.

Permanent metal forms may be used to form that portion of the concrete slab inside the webs of the steel box girders, subject to the following requirements:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

1. Metal forms shall be 18 gage minimum thickness, zinc coated, steel sheet conforming to ASTM A 653 Coating Designation G 210. All accessories shall conform to ASTM A 36 or Section 9-06.1 with a zinc coating of 2.0 ounces per square foot.
2. Forms shall be designed by the Contractor to support the plastic concrete, metal forms, steel reinforcing bars, and a construction live load of 60 pounds per square foot. Deflection of the metal form shall not exceed 1/360 of the span. Camber of the metal form shall not exceed the anticipated deflection. The working unit stress shall not exceed 0.725 of the specified yield strength of the metal form material.
3. The metal forms shall provide for the full depth of the deck slab above the uppermost portions of the form. Bottom transverse steel reinforcing bars of the deck slab shall be at least 1 inch clear of the metal forms at all points. Forms or supports shall not be welded to girder flanges.
4. The deck slab concrete shall be placed continuously between the transverse construction joints shown in the Plans, except in an emergency when the Engineer approves interrupting the concrete placement. In such an emergency, the Contractor shall construct a transverse joint at the bottom of a flute and shall field drill 1/4 inch weep holes through the metal form at 12 inch centers along the line of the joint.
5. All zinc coating on exposed metal form damaged or removed during construction shall be repaired with one coat of two mils dry film thickness Formula A-9-73 paint in accordance with Section 9-08.2.
6. Should the Engineer determine that inspection of the underside of the hardened slab is warranted, the Contractor shall remove at least one section of metal form in each span at no extra cost to the Contracting Agency. If excessive honeycomb or other defects are found, the Contractor shall, if required by the Engineer, remove additional form sections at no additional expense to the Contracting Agency, and shall revise concrete placing methods as required to produce sound concrete. All unacceptable concrete shall be removed or repaired as approved by the Engineer.
7. Complete layout, details, and a description of materials, for the permanent metal forms shall be included in the Contractor's falsework and formwork submittal as specified in Section 6-02.3(16).
8. No adjustment will be made to the lump sum contract price for "Roadway Deck - ____" for additional quantities of materials required because of the use of the permanent forms.

Placing Anchor Bolts

Section 6-02.3(18) is supplemented with the following:

Resin Bonded Anchors

The Contractor shall submit item 1 and 2 to the Engineer for all resin bonded anchor systems. If the resin bonded anchor system and anchor diameter are not listed in the current WSDOT Qualified Products List, the Contractor shall also submit item 3 to the Engineer.

1. The resin manufacturer's written installation procedure for the anchors. Resin bonding material used in overhead and horizontal application shall be specifically recommended by the resin manufacturer for those applications.
2. The manufacturer's certificate of compliance for the threaded anchor rod certifying that the anchor rod meets the requirements of this Special Provision.
3. Test results by an independent laboratory certifying that the threaded anchor rod system meets the ultimate anchor tensile load capacity specified in Section 6-02.2 as supplemented in these Special Provisions. The tests shall be performed in accordance with ASTM E 488.

The embedment depth of the anchors shall be as specified in the Plans. If the embedment depth of the anchor is not specified in the Plans then the embedment depth shall be as specified in the table of minimum and maximum torque below.

The anchors shall be installed in accordance with the resin manufacturer's written procedure.

Holes shall be drilled as specified in the Plans. Holes may be drilled with a rotary hammer drill when core drilling is not specified in the Plans. If holes are core drilled, the sides of the holes shall be roughened with a rotary hammer drill after core drilling.

Holes shall be prepared in accordance with the resin manufacturer's recommendations and shall meet the minimum requirements as specified herein. Holes drilled into concrete shall be thoroughly cleaned of debris, dust, and laitance prior to installing the threaded rod and resin bonding material. Holes shall not have any standing liquid at the time of installation of the threaded anchor rod.

Threaded anchors shall not be installed in submerged liquid environments unless specifically recommended by the resin manufacturer. The Contractor shall submit tests performed by an independent laboratory which certifies that anchors installed in a submerged environment meet the strength requirements specified in Section 6-02.2 as supplemented in these Special Provisions.

The anchor nuts shall be tightened to the following torques when the embedment equals or exceeds the minimum embedment specified.

Anchor Diameter (inch)	Minimum Torque (ft-lbs)	Maximum Torque (ft-lbs)	Minimum
			Embedment (Inch)
3/8	12	18	3-3/8

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

1/2	22	35	4-1/2
5/8	55	80	5-5/8
3/4	106	140	6-3/4
7/8	165	190	7-7/8
1	195	225	9
1-1/4	370	525	11-1/4

When the anchor embedment depth is less than the minimum values specified, the anchor nuts shall be tightened to the torque values specified in the Plans, or as recommended by the resin bonded anchor system manufacturer and approved by the Engineer.

Bridge Bearings

Elastomeric Bearing Pads

Section 6-02.3(19)A is supplemented with the following:

High-Load Elastomeric Bearing Pad Assembly

The Contractor shall install all bearings level, unless otherwise shown in the Plans.

The Contractor shall measure the slope of the top surface of the bearing and the contact surface of the bridge superstructure. If the difference in slope between these surfaces exceeds 0.005 radians, the Contractor shall adjust the surfaces to within this tolerance by shimming, grouting, or other method as approved by the Engineer.

The Contractor shall set the sole plate with epoxy gel just before setting the superstructure in place on the bearing. The Contractor shall spread a thin uniform film of silicone grease on the top surface of the sole plate in contact with the epoxy gel to prevent bonding of the sole plate to the epoxy gel. The Contractor shall grease the bolts attaching the sole plate to the superstructure to prevent bonding and allow for future removal. The Contractor shall apply epoxy gel to the bottom surface of the superstructure and immediately bolt the sole plate in place to obtain a level surface at the bottom of the sole plate. The Contractor shall set the superstructure in place on the bearing before the epoxy gel has cured, squeezing out excess epoxy gel. The Contractor shall immediately remove all excess epoxy gel and grease. After the epoxy gel has cured, the Contractor shall tighten the sole plate attachment bolts.

Bridge Bearing Assemblies

Section 6-02.3(19)B is supplemented with the following:

Fabric Pad Bearing

The fabric pad bearing consists of an upper unit and a lower unit. The upper unit includes a stainless steel sheet and either a single sole plate or upper and lower sole plates, as shown in the Plans. The lower unit includes a polytetrafluorethylene (PTFE) sheet, a steel backing plate, and a preformed fabric pad, and may also include a masonry plate, as shown in the Plans. Lower unit components of transverse restrainer bearings shall be as shown in

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build the Plans. The upper and lower units shall be supplied by a single bearing manufacturer.

Shop Drawings

The Contractor shall submit shop drawings to the Engineer for approval in accordance with Section 6-03.3(7). These drawings shall include but not be limited to the following information:

1. Plan and elevation of the bearing showing dimensions and tolerances.
2. Complete details of all components and sections showing all materials incorporated into the bearing.
3. All AASHTO, ASTM or other material designations.
4. Bearing manufacturer's recommendations and procedures for bearing assembly shipment and storage.

The Contractor shall not begin fabricating the fabric pad bearings until receiving the Engineer's approval of the shop drawings.

Flatness and Manufacturing Tolerances

Flatness of bearing surfaces shall be determined by the following method:

1. A precision straightedge, longer than the nominal dimension to be measured shall be placed in contact with the surface to be measured as parallel to it as possible.
2. A feeler gauge having an accuracy equal to the tolerance allowed \square .001 inch, shall be selected and inserted under the straightedge.
3. Surfaces are acceptable for flatness if the feeler gauge does not pass under the straightedge.
4. In determining the flatness, the straightedge may be located in any position on the surface being measured.

Flatness tolerances shall be defined as follows:

1. Class A tolerance = $0.0005 \times \text{nominal dimension}$
2. Class B tolerance = $0.001 \times \text{nominal dimension}$
3. Class C tolerance = $0.01 \times \text{nominal dimension}$

(Nominal dimension shall be taken as the actual dimension of the plate or sheet under the straightedge, in inches.)

Manufacturing tolerances for the bearings are as follows:

PTFE Sheet

Plan dimensions:	Total nominal design area -0, +1/8"
Thickness:	-0", + 1/64"
Flatness:	Class B tolerance, both surfaces

Stainless Steel Sheet

Plan dimensions:	-0", +3/16"
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Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Flatness: Class B tolerance, both surfaces

Sole Plate

Plan dimensions: -0", +3/16"

Thickness: -1/16", +3/16"

Flatness: Class B tolerance, side in contact with the Stainless Steel or sole plate

Class C tolerance, side in contact with epoxy gel, grout, or concrete

Steel Backing Plate

Plan dimensions: -0", +3/16"

Thickness: -0", +3/16"

Width and length

of recess: -0", +1/16", of PTFE sheet size

Flatness: Class B tolerance, both surfaces

Fabric Pad

Plan dimension: -0", +3/16"

Thickness: -1/16", +3/16"

Surface finish: For preformed fabric pads fabricated from multiple layers, the vertical face shall be free of visible horizontal displacement between the individual layers.

Masonry Plate & Bars

Plan dimension: -0", +3/16"

Thickness: -0", +3/16"

Flatness: Class B Tolerance, side in contact with masonry plate or bars.

Class C tolerance,

free side or side in contact with grout.

Overall Height

Total thickness: -0, +10 percent

Bearing Component Assembly, Shipping, and Storage

The stainless steel sheet shall be seal welded all around to the sole plates using the gas tungsten-arc welding process (GTAW) in accordance with applicable AWS recommended practices. The seal weld shall not protrude beyond the surface of the stainless steel. The stainless steel sheet shall be clamped down to have full contact with the sole plate during welding.

The lower contact surface of the PTFE sheet shall be bonded to the steel backing plate with epoxy specified by the PTFE manufacturer.

All exposed steel plate surfaces, including the stainless steel sheet to sole plate weld but excluding stainless steel surfaces, shall be painted in accordance with Section 6-03.3(30) as supplemented in these Special Provisions.

The Contractor shall protect the bearing assemblies from all damage, and exposure to the elements, during shipment and storage prior to installation in accordance with the manufacturer's recommendations and procedures listed in the shop drawings as approved by the Engineer.

Bearing Assembly Field Inspection and Installation

Field inspection of a representative number of bearing assemblies will be performed by the Engineer. The Contractor shall provide a clean, dry, and enclosed area at the site, spacious enough for the field inspection activities. The Engineer will identify the bearing assemblies to be inspected and the Contractor shall do all the necessary work to allow the Engineer to inspect the bearing assemblies.

The sliding surfaces shall be finished true, lubricated and installed level, or installed as shown in the Plans for transverse restrainer bearings.

PTFE sheet shall not be greased, except as otherwise noted. A thin uniform film of silicone grease shall be applied to the entire dimpled PTFE sheet before installation.

For cast-in-place concrete superstructures, the fabric pad bearing upper unit shall be anchored to the structure as shown in the Plans. For precast concrete superstructures with fabric pad bearing upper units with upper and lower sole plates, the upper sole plate shall be cast into and anchored to the precast concrete member as shown in the Plans.

The upper units of fabric pad bearings for steel superstructures, and the lower sole plate assemblies for precast concrete superstructures shall be set with epoxy gel as specified below just before setting the superstructure in place.

The sole plate top surface in contact with the epoxy gel shall receive a thin uniform film of silicone grease, to prevent bonding to the epoxy gel. The anchor bolts and insert threads shall be greased to prevent bonding and allow future removal. The Contractor shall apply the epoxy gel by troweling it into the concrete recess, or onto the bottom of the steel superstructure or upper sole plate surface, and immediately bolt the upper unit of the bearing in place to obtain a level surface. Before the epoxy gel has cured, the superstructure shall be set in place, squeezing out excess epoxy gel while filling the entire recess. Excess epoxy and grease shall be removed immediately. Special care shall be exercised at all times to ensure protection of the stainless steel and PTFE surfaces from coming in contact with concrete or any other foreign matter. After the epoxy gel has cured, the anchor bolts shall be tightened to snug tight.

The grout pad, and masonry plate (when shown in the Plans), shall be installed level. When shown with a masonry plate, the grout pad shall be pressure installed starting at the middle of the masonry plate.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
All forms and debris that tend to interfere with the free action of the bearing assemblies shall be removed at the time falsework and forms are removed.

Reinforcement

Placing and Fastening

Section 6-02.3(24)C is supplemented with the following:

Drilling Holes for, and Setting, Steel Reinforcing Bar Dowels

Where called for in the Plans, holes shall be drilled into existing concrete to the size and dimension shown in the Plans. The Design-Builder may use any method for drilling the holes provided the method selected does not damage the concrete and the steel reinforcing bar that is to remain. Core drilling will be required when specifically noted in the Plans.

The Design-Builder shall exercise care in locating and drilling the holes to avoid damage to existing steel reinforcing bars and concrete. Location of the holes may be shifted slightly with the approval of WSDOT in order to avoid damaging the existing steel reinforcing bars. All damage caused by the Design-Builder's operations shall be repaired by the Design-Builder at no cost to the Contracting Agency and the repair shall be as approved by WSDOT.

Steel reinforcing bars shall be set into the holes noted in the Plans with epoxy resin. The holes shall be blown clean with dry compressed air before placing the resin.

The Design-Builder shall demonstrate, to the satisfaction of WSDOT, that the method used for setting the steel reinforcing bars completely fills the void between the steel reinforcing bar and the concrete with epoxy resin. Dams shall be placed at the front of the holes to confine the epoxy and shall not be removed until the epoxy has cured in the hole.

Welding Reinforcing Steel

Section 6-02.3(24)E is supplemented with the following:

Where epoxy-coated steel reinforcing bars are specified to be spliced by welding, the epoxy coating shall be left off or removed from the end six inches of each bar being welded. After the welding is complete, the Contractor shall apply epoxy patching material to the uncoated portions of the bar in accordance with Section 6-02.3(24)H.

Prestressed Concrete Girders

Casting

The second paragraph of Section 6-02.3(25)B is revised to read as follows:

The Contractor shall fabricate all prestressed concrete girders using the Contractor-Provided mix design appropriate for the design strength specified for each girder in accordance with Sections 6-02.3(2)A and 9-19.1 as supplemented in these Special Provisions, and as approved by the Engineer. The temperature of the concrete when placed shall be between 50F and 90F.

Contractors Control Strength

Section 6-02.3(25)E is supplemented with the following:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

For the prestressed girders of *** WSDOT Bridge No. 405/55E and No. 405/55W ***, the Contractor may substitute compressive strength testing at 28 days provided that the 28 day compressive strength is equal to or greater than 95 percent of the required 56 day compressive strength.

Shipping

The first paragraph of Section 6-02.3(25)M is revised to read as follows:

After the girder has reached its 28-day design strength, or 95 percent of the 56 day design strength for the girders of *** WSDOT Bridge No. 405/55E and No. 405/55W ***, and the fabricator believes it to comply with the specification, the girder and a completed Certification of Compliance, signed by a Precast/Prestressed Concrete Institute Technician or a professional engineer, acceptable to the Contracting Agency, shall be submitted to the Engineer for inspection. If the Engineer finds the certification and the girder to be acceptable, the Engineer will stamp the girder “Approved for Shipment”.

The third paragraph of Section 6-02.3(25)M is supplemented with the following:

The Contractor is advised that, because of the higher compressive design strengths required for the production prestressed concrete girders of *** WSDOT Bridge No. 405/55E and No. 405/55W ***, it will take longer than the usual time for these girders to reach sufficient strength for shipping. The Contractor shall take this into account when preparing schedules for this portion of the work.

Cast-in-Place Prestressed Concrete

The third paragraph of Section 6-02.3(26) is revised to read as follows:

Before tensioning, the Contractor shall remove all side forms from the girders. The Contractor shall not release the falsework supporting the superstructure, and shall not place construction loads and other live loads on the superstructure, until the job-cured 2-inch grout cubes reach a minimum compressive strength of 800 psi.

6-03, STEEL STRUCTURES

Materials

Section 6-03.2 is supplemented with the following:

Structural high strength steel shall conform to ASTM A 709, Grade HPS 70W, with supplementary requirements S83 and S84 as applicable.

The Contractor is advised that quenched and tempered ASTM A 709 Grade HPS 70W steel plates are limited to a 50 foot maximum delivery length from the mill.

As an alternative, Grade HPS 70W thermo-mechanical-controlled-processing (TMCP) steel plates with a minimum specified yield point of 70 ksi are also available from the manufacturer in limited thicknesses, and may be directly substituted for the quenched and tempered product.

Pin Bearing

Unless other materials are specified in the Plans, pin bearing assembly components shall conform to the following requirements for those components shown and specified in the Plans:

Steel Plates and Bars

Steel plates and bars (base plate, bearing plate, sole plate, and guide bar) shall conform to ASTM A 36, and the dimensions shall comply with the details as shown in the Plans. The surface of pin bearing assembly steel components in contact with stainless steel and with the bearing block shall have an average surface roughness of 125 microinches or less. The surface within the recess of steel plates and bars retaining PTFE shall have an average surface roughness of 250 microinches or less. All other base plate, bearing plate, sole plate, and guide bar surfaces in contact with other pin bearing assembly components shall have an average surface roughness of 500 microinches or less.

Polytetrafluoroethylene (PTFE)

PTFE shall be 100 percent virgin PTFE, woven PTFE fabric, or dimpled PTFE conforming to Section 18.8.2 of the AASHTO LRFD Bridge Construction Specifications, 1st Edition and latest interims.

Stainless Steel

Stainless steel sheet shall conform to ASTM A 240 Type 304L. Stainless steel in contact with PTFE shall be polished to a Number 8 mirror finish.

Stainless steel countersunk screws shall be hexagon socket type conforming to ANSI B 18.3 and shall conform to ASTM F 593 Type 304L.

Silicone Grease

Silicone grease shall conform to Military Specification MIL-S-8660.

Bolts, Nuts and Washers

Bolts, nuts and washers shall conform to Section 9-06.5(3).

Anchor Bolt Assembly

Anchor bolts shall conform to ASTM F 1554 Grade 105, including supplemental requirements S2, S3, and S5. Nuts shall conform to AASHTO M 291 Grade DH. Washers shall conform to AASHTO M 293. Bars shall conform to ASTM A 36. Pipe shall conform to ASTM A 53 Grade B Type E or S, black.

Resin Filler

Resin filler shall conform to Section 6-02.2 as supplemented in these Special Provisions.

Bearing Blocks and Keeper Rings

Bearing block forgings shall conform to Section 9-06.11, including AASHTO M 102 Supplemental Requirement S4. The grade shall be Grade F. The bearing block forging surfaces in contact with other pin bearing assembly components shall have an average surface roughness of 125 microinches or less. All other bearing block forging surfaces shall have an average surface roughness of 500 microinches or less.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Keeper ring forgings shall conform to Section 9-06.11 and the grade shall be Grade H. All keeper ring surfaces shall have an average surface roughness of 125 microinches or less.

Pin Assembly

Pins shall conform to ASTM A 276, UNS Designation 21800. Nuts shall conform to AASHTO M 291 Grade DH. Nuts with a thread diameter equal to or less than six inches shall have a minimum Rockwell Hardness of HRc 24. Nuts with a thread diameter greater than six inches shall have a Rockwell Hardness between HRc 20 and HRc 30. Washers shall conform to ASTM A 572 Grade 50. Cotter pins shall be stainless steel. The pin surfaces in contact with the bearing blocks shall have an average surface roughness of 125 microinches or less.

Submittals of Acceptance Test Reports and Certificates

The Contractor shall submit the following production samples, and test reports and certificates, to the Engineer for review, testing, and approval:

1. Manufacturer's certificate of compliance for the PTFE, resin filler, and silicone grease, in accordance with Section 1-06.3.
2. A two inch by three inch by 1/8 inch sample of PTFE taken from the lot of production material.
3. Certified mill test reports for all steel and stainless steel materials incorporated in the bearings.

The Contractor shall not ship the bearings from the fabricator's facility until receiving the Engineer's written approval of all production samples, and test reports and certificates.

Construction Requirements

Section 6-03.3 is supplemented with the following:

Structural steel fabricators for HPS Steel for WSDOT Bridge No. 405/55E and No. 405/55W shall be certified under the AISC Quality Certification Program, Major Steel Bridges Category, with endorsement F, Fracture Critical. Prior to approval for fabrication, the results of the latest AISC certification review shall be submitted to the Engineer.

Pin Bearing

Shop Drawings

The Contractor shall submit shop drawings to the Engineer for approval in accordance with Section 6-03.3(7). These drawings shall include but not be limited to the following information:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

1. Plan and elevation of the assembled bearing and each of the components showing dimensions and tolerances.
2. Complete details of all components and sections showing all materials incorporated into the bearing.
3. All AASHTO, ASTM or other material designations.
4. All surface finishes.
5. Bearing manufacturer's recommendations and procedures for bearing assembly shipment, storage, and installation.

The Contractor shall not begin fabricating the pin bearings until receiving the Engineer's approval of the shop drawings.

Shop Inspection

The manufacturer shall provide for inspection. Inspection during the fabrication process shall ensure that the materials and workmanship meet the requirements of the contract. Inspection shall be performed by an independent inspection entity approved by the Engineer.

The Contractor shall submit the name, address, phone number and contact person of the inspection entity performing the required certified shop inspection of the bearings to the Engineer for approval. The Contractor shall not begin bearing fabrication until receiving the Engineer's written approval of the inspection entity for certified shop inspection.

Flatness and Manufacturing Tolerances

Flatness of bearing surfaces shall be determined by the following method:

1. A precision straightedge, longer than the nominal dimension to be measured shall be placed in contact with the surface to be measured as parallel to it as possible.
2. A feeler gauge having an accuracy of ± 0.001 inches equal to the tolerance allowed shall be selected and inserted under the straightedge.
3. If the feeler gauge does not pass under the straightedge, the surfaces shall be acceptable for flatness.
4. In determining the flatness, the straightedge may be located in any position on the surface being measured.

Flatness tolerances shall be defined as follows:

1. Class A tolerance = $0.001 \times \text{nominal dimension}$
2. Class B tolerance = $0.002 \times \text{nominal dimension}$
3. Class C tolerance = $0.005 \times \text{nominal dimension}$

(Nominal dimension shall be taken as the actual dimension of the plate or sheet under the straightedge, in inches.)

Manufacturing tolerances for the bearings are as follows:

Base Plate, Bearing Plate and Sole Plate

Plan dimensions

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Greater than 30 inches:	-0.00, +3/16 inch
30 inches or less:	-0.00, +1/8 inch
Thickness:	-1/32, +1/8 inch
Flatness:	Class A tolerance, side in contact with steel or PTFE
	Class C tolerance, side in contact with grout or concrete

Guide Bar

Length:	$\pm 1/8$ inch
Section dimensions:	$\pm 1/16$ inch
Flatness:	Class A tolerance, side in contact with steel or PTFE
Bar to bar tolerance:	$\pm 1/32$ inch
Bars shall be not more than 1/32" out of parallel	

PTFE Sheet

Plan dimensions:	Total nominal design area -0, +5 percent
Thickness:	-0.00, +1/64 inch
Flatness:	Class A tolerance
PTFE Recess:	Length and width -0.00, +0.04 inch

Stainless Steel Sheet

Flatness:	Class A tolerance
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Bearing Block

Plan dimensions:	-0.00, +1/8 inch
Thickness:	± 0.015 inch
Groove radius for pin:	As shown in the Plans

Keeper ring grooves in bearing blocks

Radius, inner and outer:	± 0.005 inch
Depth of groove:	± 0.010 inch

Keeper Ring

Radius, inner and outer:	± 0.010 inch
Thickness:	± 0.030 inch

Pin

Length, shldr. to shldr.: +0.000, -0.020 inch
Diameter: As shown in the Plans

Overall Height

Total thickness: -1/16, +3/16 inch

The edges of all components shall be broken by grinding so that there are no sharp edges.

Special Fabrication Requirements

When the following components are shown in the Plans as part of the pin bearing assembly, the following special fabrication requirements shall apply:

PTFE Sheet

PTFE shall be 1/8 inch thick unless otherwise noted in the Plans. PTFE shall be recessed and bonded to a depth of one half the PTFE sheet thickness into the backing plate. The exposed height of the PTFE shall not be less than 3/64 inch.

Dimpled PTFE, if shown in the Plans, shall be unfilled and have a minimum thickness of 3/16 inch. Dimples shall be placed in a 1/2 inch grid and shall have a depth of 1/16 inch.

The PTFE sheet shall be recessed and chemically bonded to the supporting steel plate or bar. The woven PTFE sheet shall be mechanically bonded to the supporting steel plate or bar. Bonding shall be performed under controlled conditions and in accordance with the written instructions of the PTFE manufacturer.

Following the bonding operation, the PTFE surface shall be smooth and free from bubbles. Filled PTFE shall be polished after the bonding operation is complete, in accordance with AASHTO LRFD Bridge Construction Specification Section 18.8.3.2.2.

Stainless Steel Sheet

The stainless steel sheet shall be seal welded all around to the supporting steel plate or bar by the gas tungsten arc welding (GTAW) process in accordance with current AWS specifications. The stainless steel sheet shall be clamped down to have full contact with the supporting steel plate or bar during welding. The welds shall not protrude beyond the sliding surface of the stainless steel sheet.

Guide Bar

Each guide bar shall be fabricated from a single steel plate. The guide bars shall be bolted to the pin bearing assembly as shown in the Plans. The stainless steel sheet shall be welded to the guide bar before attaching the guide bar to the pin bearing assembly. The space between the guide bar and the guided component shall be 3/16 inch \pm 1/16 inch.

Corrosion Protection

Steel surfaces, except as otherwise specified, shall be painted in accordance with Section 6-07.3(1), and Section 6-03.3(30) as supplemented in these Special Provisions. The surfaces of all welds fastening stainless steel to structural steel shall be painted as specified for structural steel. Stainless steel shall not be painted. The second and third coats of paint shall be applied after the pin bearing assembly has been erected in its final position with the anchor bolt nuts and pin nuts installed.

The anchor bolts, and associated nuts and washers and pipe assembly, shall not be painted. The upper portion of the anchor bolts, and associated nuts and washers, to six inches minimum below the concrete surface, shall be galvanized after fabrication in accordance with AASHTO M 232.

The following items shall be painted only with one shop applied coat of inorganic zinc primer in accordance with Section 6-07.3(1):

1. The keeper rings.
2. The keeper ring groove surface in the bearing blocks.

The following items and surfaces shall not be painted, but shall instead be coated with #2 extreme pressure grease:

1. The machined surfaces of the bearing blocks that contact the pin and keeper rings.
2. All surfaces of the pins.
3. The threads of the pin nuts.

The primer paint coated keeper rings shall be coated with #2 extreme pressure grease prior to final bearing assembly.

Bearing Assembly Inspection Reports and Certification

The Contractor shall submit the daily inspection reports of the independent inspection entity performing the required certified shop inspection to the Engineer for approval. The daily inspection reports shall report on the shop fabrication and testing activities relating to the bearing assemblies, and their conformance to the specification requirements.

The Contractor shall submit written documentation from the bearing manufacturer certifying that the bearing assemblies have been manufactured in full compliance with the specification requirements.

The Contractor shall not ship the bearing assemblies from the fabricator's facility until receiving the Engineer's approval of the certified shop inspection daily inspection reports and the bearing manufacturer's certificate of compliance.

Bearing Component Assembly, Shipping, and Storage

Each bearing shall be fully assembled at the manufacturing plant and delivered to the construction site as a complete unit, ready for installation. The units shall be held together with removable restraints so that the sliding surfaces are not damaged.

All bearing assemblies shall be marked with the following information prior to shipping:

1. Location of the bearing, including the pier and the specific location along the pier.
2. Direction arrow pointing in the ahead on station direction.

The above information shall be marked on the top plate of the upper unit of the bearing assembly. The marks shall be permanent and shall be visible after bearing installation.

The bearing assemblies shall have centerlines marked on both upper and lower units for checking alignment in the field.

The bearing assemblies shall be shipped in light-proof, moisture-proof and dust-proof containers.

Bearing Assembly Field Inspection

Field inspection of a representative number of bearings assemblies will be performed by the Engineer. The Contractor shall provide a clean, dry and enclosed area at the site, spacious enough for the field inspection activities. The Contractor shall disassemble and reassemble the bearings for inspection by the Engineer. The disassembly and reassembly of the bearings shall be in accordance with the bearing manufacturer's written procedure and in the presence of the Engineer.

Bearings that fail the inspection shall be replaced or repaired by the Contractor, as approved by the Engineer, at no additional expense to the Contracting Agency. All proposed corrective procedures shall be submitted by the Contractor to the Engineer for approval before beginning corrective work.

Shop Plans

Erection Methods

The list in the second paragraph of Section 6-03.3(7)A is supplemented with the following:

8. If the Contractor selects a girder launching method as the erection procedure, the Contractor shall submit plan details of the nose beam, roller assemblies, jacks, blocking, tow lines and control lines, and shall prepare an erection procedure that describes the method and equipment involved in the launching procedure, the elevation and alignment control and corrective measures enforced during the launching process, the methods of monitoring and adjusting the tow line and control line loads during the launching process, and the spare jacks, tow lines, control lines, and other critical field erection equipment provided to ensure a continuous and safe operations.

Workmanship and Finish

Section 6-03.3(11) is supplemented with the following:

All fabrication of high strength steel conforming to ASTM A709 Grade HPS 70W shall conform to the latest edition of the AASHTO Guide Specifications for Highway Bridge Fabrication with HPS 70W Steel, except as modified by these Special Provisions.

Short term application of heat for purposes of heat curving, heat straightening, camber and sweep adjustment, or other reasons, shall conform to Sections 6-03.3(10) and 6-03.3(18), and is limited to 1,100F maximum.

Planing of Bearing Surfaces

Section 6-03.3(15) is supplemented with the following:

Where mill to bear is specified in the Plans, the bearing end of the stiffener shall be flush and square with the flange and shall have at least 75 percent of this area in contact with the flange.

Built Members

Section 6-03.3(18) is supplemented with the following:

Heat Curving

The Contractor may use heat curving methods to fabricate specific steel components, subject to the following requirements:

1. The steel components shall either be flange plates of welded steel plate girders, or top flange plates and longitudinal bottom flange stiffeners of welded steel box girders.
2. The horizontal curvature measured to the centerline of the steel component shall be greater than or equal to 500 feet, except that the horizontal curvature dimension shall be greater than or equal to 1,000 feet if the steel component thickness exceeds 3 inches or the steel component width exceeds 30 inches. Steel components not meeting these geometric requirements shall be sheared or flame-cut to the specified geometry.
3. The Contractor submits a heat curving plan to the Engineer and receives the Engineer's approval of the submittal.
4. The heat curving operations shall conform to the approved heat curving plan and the requirements of this Section.
5. All heat curving shall be performed in the fabricator's shop or facility.

Submittals

The Contractor shall submit a heat curving plan to the Engineer in accordance with Section 6-03.3(7) along with the steel member fabrication shop drawings. The heat curving plan shall include, but not be limited to, the following:

1. The methods of preparing the steel components for heat curving.
2. The methods of handling and supporting the steel components during heat curving operations.
3. The heating torches and tips to be used.
4. The heating procedure and pattern to be used.
5. The temperature measuring devices to be used to monitor the temperature of the steel component.
6. The cooling methods to be used.

The Contractor shall not begin heat curving operations until receiving the Engineer's approval of the heat curving plan.

Equipment

Heat curving shall be performed using large multiorifice (rosebud) heating torches selected as appropriate to promote heating efficiency and to prevent unnecessary distortion. The torches and tips shall be as specified in the heat curving plan as approved by the Engineer.

Process

All flange butt welds for the steel component shall be completed prior to heat curving. All web butt welds shall be completed prior to connecting the web to the flange. All heat curving operations shall be completed prior to connecting the web to the flange, and prior to shop painting.

The steel components shall be handled and supported as specified in the heat curving plan as approved by the Engineer.

Only truncated triangular heating patterns shall be used. The base of the triangle shall be the edge of the steel component that is to be concave after heat curving. The heating patterns shall be spaced uniformly along the full length of both edges of the steel component to produce a circular, not parabolic, curvature. The heating patterns shall be adjusted as necessary to produce the specified curvature, compensating for differences in steel component thickness and width. Care shall be taken when heating relatively thin, wide plates to guard against buckling.

The heat curving process shall bring the temperature of the steel within the specified pattern to between 1,000F and 1,100F as rapidly as possible without overheating the steel. The heating torches shall be manipulated to prevent general and localized overheating. Heat measurements shall be made after the heating flame has been removed from the steel component.

Heat procedures that raise the temperature of any portion of the steel component above 1,100F shall be considered destructive heating. Destructive heating shall be cause for rejection of the steel component, subject to the Engineer's evaluation. Steel components damaged by destructive heating and subject to rejection may have the damaged portion repaired or replaced by the Contractor at no additional cost to the Contracting Agency, subject to the Engineer's approval of the repair and post-repair testing procedures. The repaired steel component may be accepted subject to successful post-repair testing and the Engineer's approval.

Quenching with water or water and air will not be permitted. Cooling with dry compressed air will be permitted after the steel component has cooled to 600F.

Welding and Repair Welding

Section 6-03.3(25) is supplemented with the following:

Welding Requirements for ASTM A 709 Grade HPS 70W Steel

All welding shall conform to the latest edition of the AASHTO Guide Specifications for Highway Bridge Fabrication with HPS 70W Steel.

Use of the ESAB ENi4 electrode in combination with Lincoln Mil800H flux will not be allowed.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Only submerged arc and shielded metal arc welding processes will be permitted. Consumable handling requirements shall be in accordance with AWS D1.5, Sections 12.6.5 and 12.6.6, except that SAW consumables shall meet the hydrogen control level of H4 as discussed in AWS D1.5, Section 12, Article 12.6.2. SMAW consumables shall meet either H4 or H8 except the higher preheat and interpass temperatures as noted in Table 3 of the AASHTO Guide Specifications for Highway Bridge Fabrication with HPS 70W Steel apply to H8 conditions.

Filler metals used to make single pass fillet welds for web to flange applications, and for attaching stiffeners and connection plates to webs and flanges, shall conform to AWS D1.5, Table 4.1 for ASTM A 709 Grade 50W base metal. Filler metals for single pass fillet welds need not meet the requirements for exposed bare applications.

Filler metals used for all complete penetration groove welds connecting Grade HPS 70W plate to ASTM A 709 Grade 50W plate may conform to the requirements for welding Grade 50W base metal, or may conform to the requirements for welding Grade HPS 70W base metal as listed below.

Filler metals used for all complete penetration groove welds connecting Grade HPS 70W plates shall conform to the requirements for HPS 70W base metal as follows:

Submerged Arc Welding process:

Wire	LA85 by Lincoln Electric Company
Flux	MIL800HPNi by Lincoln Electric Company

Shielded Metal Arc Welding process:

Matching	E9018MR*
Undermatching	E7018MR*

* the designator MR, for moisture resistant coating, is required for all SMAW electrodes used for welding HPS 70W steels.

The Contractor may request approval of alternative consumables in lieu of the above filler metals for SAW. The request for approval shall include documentation of successful welding in accordance with the AWS D1.5 Bridge Welding Code, and include diffusible hydrogen tests as described in AWS D1.5, Article 12.6.2 indicating the deposited weld metal under proposed fabrication shop conditions has a diffusible hydrogen level equivalent to H4 or less.

If specified in the Plans, additional weld procedure qualification tests shall measure the Charpy V-notch toughness of the coarse grained area of the heat affected zone (HAZ). The notch in the specimens shall be carefully located in the coarse grained area of the HAZ, as determined by macroetching the specimens prior to machining and testing. The toughness requirement for the HAZ shall be the same as the weld metal.

All procedure qualification tests shall be ultrasonically tested in accordance with AWS D1.5-96, Section 6, Part C. Evaluation shall conform to AWS D1.5-96, Table 9.1, Ultrasonic Acceptance - Rejection Criteria - Tensile Stress. Indications found at the interface of the backing bar may be disregarded, regardless of the defect rating.

The Engineer shall be allowed to witness all welding procedure specification qualification tests.

In general, post weld heat treatment shall not be required. The use of such post weld heat treatment shall require additional qualification testing.

Whenever magnetic particle testing is done, only the yoke technique will be allowed, as described in Section 6.7.6.2 of the AASHTO/ AWS D1.5 Bridge Welding Code, modified to test using alternating current only. The prod technique will not be allowed.

Narrow Gap Improved-Electroslag Welding (NGI-ESW) Procedure

The NGI-ESW procedure may be used for groove welds in bridge members and member components up to four inches thick subject to the following requirements:

In members subject to applied tensile stress under any loading condition, the NGI-ESW procedure may be used provided:

1. The NGI-ESW procedure is qualified in accordance with the AASHTO/AWS D1.5M/D1.5:2002 Section 5.13 and 5.14 procedure qualification tests, and satisfies the following criteria:
 - a. Weld Metal: 20 foot-pounds at 0F.
 - b. HAZ: 15 foot-pounds at 40F.

2. The application is limited to AASHTO temperature Zone I and Zone II.

The NGI-ESW procedure qualified for welding of tension members will be considered as also qualified for compression members without additional testing.

The NGI-ESW procedure shall not be used for fracture-critical members.

NGI-ESW shall be used only with AASHTO M 270 Grades 36, 50 and 50W steel, and ASTM A 709 Grades 36, 50 and 50W steel.

Oscillation is not permitted in the NGI-ESW procedure, unless qualified by test and approved by the Engineer.

Preheat is not required for NGI-ESW.

Welding Procedure Specification (WPS) Submittal

The welding procedure specification submittal for NGI-ESW shall include, but not be limited to, the following:

1. Process type (eg. NGI-ESW).
2. Guide design (eg. wing or web type), number of wires, and material used for the guide (eg. AISI 1008 steel).
3. Flux type, including the amount added initially, and the subsequent flux feed rate.
4. Joint details, such as the joint gap dimension and the plate thickness(es).
5. Base metal.
6. AWS electrode designation, composition, diameter, manufacturer, product name, type (eg. tubular metal power cored).

7. Wire feed speed.
8. Type and polarity of current (eg. DC electrode positive (DCEP)).
9. Current and voltage.
10. Power source characteristics (eg. constant voltage and 100 percent duty cycle rating at 1500 amps).
11. Details of water-cooled shoes such as reinforcement groove dimensions and coolant flow rate.
12. Type of sealing material used to prevent slag run-outs.
13. Accessories used within the weld zone (eg. type of insulating tape used to brace the consumable guide).

Qualification Testing

The Contractor shall provide the opportunity for Contracting Agency representatives and NCI-ESW development personnel from the Oregon Graduate Institute of Science and Technology or the equipment manufacturer to witness all qualification testing.

Toughness Revisions to AASHTO/AWS D1.5M/D1.5:2002 Table 4.2

To utilize NGI-ESW, the following revisions to Table 4.2 are required:

Non-Tension Members

Grade 36	NGI-ESW = 20 foot-pounds at 0F	Zones I & II
Grade 50	NGI-ESW = 20 foot-pounds at 0F	Zones I & II
Grade 50W	NGI-ESW = 20 foot-pounds at 0F	Zones I & II

Tension Members

Grade 36	NGI-ESW = 20 foot-pounds at 0F	Zones I & II
Grade 50	NGI-ESW = 20 foot-pounds at 0F	Zones I & II
Grade 50W	NGI-ESW = 20 foot-pounds at 0F	Zones I & II

HAZ of Tension and Reversal Members

CVN toughness of the heat-affected zones (on both sides of the narrow gap improved-electroslag weld) shall meet or exceed 15 foot-pounds at 40F.

Electrode

Electrode wire for NGI-ESW shall be FES70-EWTX with a maximum diameter of 3/32 inch. Electrode wire shall conform to the following chemistry requirements:

Element	Percent by Weight (maximum unless range is specified)
C	0.03
Mn	1.0 – 1.4

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Si	0.3 – 0.45
Ni	2.7 – 3.2
Mo	0.25 – 0.45
Ti	0.01 – 0.04
Al	0.01
S	0.015
P	0.015
V	0.005
B	0.0005
Cu	0.01
Nb	0.01

The electrode wire chemistry shall be evaluated by a melt button of the electrode, analyzed by spectrometer. If the spectrometer accuracy for low carbon and sulfur content is not adequate, additional analyzing of these elements may be accomplished by other methods.

The electrode shall be analyzed for diffusible hydrogen by the GMAW process shielded by 100 percent argon at 40 – 50 CFH. The maximum diffusible hydrogen shall be 4 ml per 100 grams.

The electrode wire material shall have a tensile strength of 70 to 95 ksi, a minimum yield strength of 50 ksi, a minimum elongation of 22 percent, and minimum charpy V-notch toughness of 20 foot-pounds at 0F.

Electrode wire shall be dry and free of contamination from dirt, grease, rust and other foreign material. Electrodes shall be received in undamaged moisture-resistant packages. Electrodes shall be protected against contamination and damage during shipment and storage. Electrodes in packages damaged during shipment and storage shall be discarded and not used. Electrode packages shall remain effectively sealed against moisture until the electrode is required for use. When removed from the protective packaging and installed on the welding machines, care shall be taken to protect the electrodes from deterioration and damage. When welding is suspended for more than eight hours, the electrodes shall be removed from the welding machines and stored in accordance with the electrode manufacturer's recommendations.

Consumable Guides

The consumable guide chemical composition shall conform to the following maximum limits:

Element	Percent by Weight
C	0.06
Mn	1.0
Si	0.6

Cr	0.1
Ni	0.23
Mo	0.03
Al	0.05
Cu	0.05
Ti	0.05
S	0.02
P	0.02

Consumable guides shall be dry and free of contamination from dirt, grease, rust, and other foreign material, and shall be in suitable condition for use. Consumable guides shall be received in undamaged moisture-resistant packages. Consumable guides shall be protected against contamination and damage during shipment and storage. After removal from the package, the consumable guides shall be protected and stored to remain free of rust, moisture, and other contaminants that may affect welding properties.

The distance from the edge of the consumable guide to the surface of the weld plate shall be not less than 1/4 inch nor greater than 7/8 inch. The distance from the center of the electrode wire to the surface of the weld plate shall be not less than 1/2 inch nor greater than 1-1/4 inch. For consumable guides designed for multiple electrodes, the electrode separation (center to center) shall not exceed two inches.

The electrode wire passage shall be a diameter or width of 0.105 inches \pm 0.008 inches to allow proper current transfer from the electrode wire.

Configurations of consumable guides for NGI-ESW shall be in accordance with Figure R1 as shown in Plans, or equivalent, subject to successful qualification testing.

The purposes of the wing (single wire) and web (dual wire) guide arrangements are to: (1) reduce solidification cracking susceptibility by distributing the heat across the weld pool and increase the weld w/d (width/depth) ratio, (2) increase current-carrying capacity of the electrode-guide assembly, and (3) stiffen the guide assembly.

The consumable guides shown in Figure R1 (A through E) are suggested designs for equal-thickness butt joints and for transition thickness butt joints. For example, the designs shown in Figures R1 A and B may be used for ESW with single electrode arrangements for either 1-1/4 inch equal-thickness butt joints, or 1-1/4 to 2 inch transition-thickness butt joints. In a second example, the designs shown in Figures R1 A, C and D may be used for 2 inch equal-thickness butt joints.

Root Face and Adjacent Faying Surface Preparation

Surfaces of the plate within one inch of the weld joint, and all surfaces on which weld metal will be deposited, shall be free of mill scale, corrosion and other contaminants. The groove preparation for NGI-ESW shall be square with a root opening of 3/4 inch \pm 1/8 inch.

Starting Sump and Run-off Tabs

The starting sump and run-off tab area shall have at least the same dimensions as those used for procedure qualification. The sump depth shall be not less than three inches. Tack welds joining steel tabs and steel sumps to the plates shall be placed within the joint being welded in order to completely remelt and incorporate the tack welds during the subsequent ESW process. If tack welds on permanent base metal are not remelted, the tack welds, and a 1/8 inch deep layer of the base metal under the tack welds, shall be removed to remove the heat-affected zone. Grade 50W sumps and run-off tabs shall be used for welding Grade 50W material. Grade 50 or 50W sumps and run-off tabs may be used for welding Grade 50 and Grade 36 material. Grade 36 sumps and run-off tabs shall be used only for welding Grade 36 material.

Flux Basicity and Condition

The basicity of flux used for NGI-ESW shall be neutral to ensure uniform weld metal composition throughout the length of weld. Fused fluxes will be required. Flux shall be dry and free of contamination from dirt, grease mill scale, or other foreign material. Flux shall be received in moisture-resistant packaging that can be stored under normal conditions for at least six months without affecting the welding characteristics or weld properties of the flux. Flux supplied by the manufacturer in a sealed package may be dispensed for use without drying if that use occurs within four hours of opening the package. Flux that has been exposed for more than four hours shall be conditioned at 250F for at least two hours prior to welding, or as recommended by the manufacturer, and stored at the same temperature until dispensed for use. Flux from packages damaged in transit or in handling shall be discarded. Flux that has been wet shall not be used.

Insulators

Insulators shall be kept dry and free of contamination from dirt, grease and other foreign material. Insulators shall be stored in sealed packages or according to the insulator manufacturer's guidelines. The material composition of the insulators shall be compatible with the flux for NGI-ESW and shall not affect mechanical properties of the weld.

Retaining Shoes

The portions of retaining shoes in contact with molten metal and base metal adjacent to the weld shall be (1) made of copper and (2) water cooled. Copper shoes shall fit tightly on the plate surface to prevent slag leakage. Only dry refractory material shall be used to fill shoe-to-plate gaps. Water-based sealers shall be limited to reinforcing previously placed tape along the outside edges of the shoes to prevent slag leakage.

Procedure for Electroslag Welding

Using the NGI-ESW procedure, welds shall be started in such a manner as to permit sufficient heat buildup for complete fusion of the weld metal to the groove faces of the joint before the weld leaves the sump. Restarts will not be allowed between the end of the weld and three inches from the beginning of the weld. If the weld cannot be completed, it shall be removed to at least 1/8 inch beyond the widest part of the weld nugget and rewelded.

Flux Additions and Slag Depth Control

After the NGI-ESW process has been established, flux additions shall be continuously regulated using an automatic feeding device. The slag pool depth qualified in the PQR shall be maintained. Slag depletion shall be monitored through current fluctuations on a continuous current and voltage chart recorder (or similar recording equipment). Alternatively, this process may be automated.

WPS Pretest and WPS Qualification

A WPS pretest is a WPS qualification test in accordance with AASHTO/AWS D1.5M/D1.5:2002 Section 5.12 and Figure 5.1 by someone other than the Contractor, but used by the Contractor as a basis for preparing WPS's. WPS pretests will not be permitted for NGI-ESW welds subject to tensile stress.

AASHTO/AWS D1.5M/D1.5:2002 Figure 5.2 shall be used for NGI-ESW qualification. If transition joints between thick and thin members are made, the PQT shall be conducted on the thinner of the two plates.

Inspection

Testing of welds made by NGI-ESW for compression members shall be in accordance with AASHTO/AWS D1.5M/D1.5:2002 Section 6. All welds deposited by NGI-ESW subjected to applied tensile stress shall be 100 percent tested using both radiographic and ultrasonic methods, and evaluated in accordance with AASHTO/AWS D1.5M/D1.5:2002.

Repair Welding

Repair welding of electroslog welds deposited on compression members shall be in accordance with AASHTO/AWS D1.5M/D1.5:2002, except as otherwise noted. Repair of NGI-ESW welds carrying applied tensile stresses shall be conducted in accordance with AASHTO/AWS D1.5M/D1.5:2002 Section 12.17 with the following exception.

Welds having defects prohibited by AASHTO/AWS D1.5M/D1.5:2002 Section 6.26 shall be repaired in accordance with an approved procedure using a qualified weld process, or the entire weld shall be removed to at least 1/8 inch beyond the widest part of the weld nugget and rewelded. If the depth of detectable cracks is within 1/4 inch of the weld centerline and if the cracking is longer than 15 percent of the weld length (not including the run-on and run-off tabs), the weld shall not be repaired, but instead shall be removed to at least 1/8 inch beyond the widest part of the weld nugget and shall be rewelded. The widest part of the weld may be estimated by cutting 1/2 inch beyond the visible reinforcement for tension members.

Weld Specimens, Type and Number of Tests for NGI-ESW

Weld metal specimens deposited by NGI-ESW and subject to applied tensile stress shall be prepared for mechanical testing in accordance with Figure R2 as shown in the Plans, and AASHTO/AWS D1.5M/D1.5:2002 Table 5.5, plus additional CVN testing of the heat-affected zone (HAZ).

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
HAZ Specimens, Type and Number of Tests for NGI-ESW

For all compression members including NGI-ESW of compression members, CVN testing of the HAZ is not required. However, for welds deposited by NGI-ESW on tension members, additional CVN tests of the HAZ shall be performed to qualify the process. The CVN tests for the HAZ shall be the following:

1. Five specimens shall be removed from the quarter-thickness section of the HAZ on each side of the procedure qualification welded joint in accordance with Figures R2 and R3 as shown in the Plans.
2. The weld fusion line shall be revealed by etching the transverse-to-weld section.
3. The notch location shall be in the base metal within 1/16 inch from the weld fusion line. If the weld curvature does not permit the entire notch to be placed within 1/16 inch from the fusion line, then one end of the notch shall be placed on the fusion line while the remaining portion of the notch extends away from the fusion line into the base metal.

If different grades of steel such as 36 and 50 or 50 and 50W are joined by NGI-ESW, the procedure qualification tests shall be conducted on the same two grades of steel. If transition joints between thick and thin members are made, the WPS shall be conducted on the same joint preparation (having the same thicknesses and joint transition slope). The heat affected zone CVN toughness specimens shall be extracted from both sides of the transition joint.

Test Results Required for NGI-ESW

Weld Metal

Eight specimens at mid-thickness location of the weld center shall be tested as shown in AASHTO/AWS D1.5M/D1.5:2002 Table 5.5. The highest and lowest values shall be discarded and the remaining six values shall be averaged. For tests to be successful, the average of the remaining six CVN test values shall meet or exceed the minimum energy value of 20 foot-pounds at 0F for welds subject to applied tensile stress. No more than two of the remaining six specimens may have an impact energy value less than the minimum specified, and none of the remaining six specimens shall have an impact energy value less than 2/3 of the minimum specified. If the NGI-ESW process is used for a compression member, the requirements are the same as those for conventional ESW as specified in AASHTO/AWS D1.5M/D1.5:2002 Table 4.2.

HAZ

For CVN toughness determination in welds carrying applied tensile stress, five specimens taken at the quarter-thickness location of the weld, in accordance with Figure R2 as shown in the Plans, shall be tested. The highest and lowest values shall be disregarded and the remaining three values shall be averaged. For tests to be successful, the average of the remaining three CVN test values shall meet or exceed the minimum CVN energy values of 15 foot-pounds at 40F. No more than one of the three remaining specimens shall have an impact energy value less than the minimum

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
specified and none of the three remaining specimens shall have a value less than 2/3 of the minimum specified value.

References

The following documents are listed as reference for qualification testing and production welding:

D1.5 Bridge Welding Code Proposed Revisions to Include Narrow-Gap Improved Electroslag Welding

Procedural Information on Narrow-Gap Improved Electroslag Welding Report No. FHWA-SA-96-050

Training Manual for Narrow-Gap Improved Electroslag Welding

A Step-by-Step Presentation of Basic Skills Required for Assembly and Welding Report No. FHWA-SA-96-051

Process Operational Guide for Narrow-Gap Improved Electroslag Welding

Procedural Information on Narrow-Gap Improved Electroslag Welding Report No. FHWA-SA-96-052

Technical Information Guide for Narrow-Gap Improved Electroslag Welding

Metallurgical Background for Narrow-Gap Improved Electroslag Welding Procedure Report No. FHWA-SA-96-053

In the event of conflicts between the references listed above and this Special Provision, this Special Provision shall govern.

Bolted Connections

Section 6-03.3(33) is supplemented with the following:

All bolted connections for bridge structures shall use Type 3 bolts.

Swinging the Span

Section 6-03.3(39) is supplemented with the following:

The Contractor shall measure and submit to the Engineer camber values at the points indicated in the Plans at each of the following times:

1. After the spans are swung.
2. After roadway slab placement.

6-05, PILING

Construction Requirements

Driving Piles

Achieving Minimum Tip Elevation and Bearing

Section 6-05.3(11)D is supplemented with the following:

The areas where piles are to be driven are adjacent to highly developed areas. It is essential that vibration and noise resulting from pile driving be held to a minimum. Unless otherwise approved by the Engineer, pile driving shall be done during regular daytime working hours. The Contractor shall select pile

driving equipment which will minimize noise and vibration. When, in the opinion of the Engineer, noise or vibration are excessive, the Contractor will be required to use a hammer that does not exceed the minimum specifications by more than 10 percent for the type and capacity of piling being driven. The *** \$\$1\$\$ *** piles *** \$\$2\$\$ *** shall be placed in prebored holes drilled to elevation ***\$\$3\$\$\$***.

If pre-boring is used, the holes shall be of adequate diameter to isolate the pile from skin friction. The hole around the pile due to oversize boring shall be filled with dry sand or pea gravel as approved by the Engineer after the pile is placed.

The diameter of the preboring shall be adjusted to provide for full contact between the pile casing and the surrounding soil without shattering the soil formation. It is estimated that the required diameter for preboring will be approximately 1 inch less than the pile diameter; however, the diameter shall be adjusted by the Contractor as directed by the Engineer to accomplish the results described above. Jetting will not be permitted. The Contractor shall follow preboring immediately with the placing of the pile casing to prevent sloughing into the excavated hole.

6-09, MODIFIED CONCRETE OVERLAYS

Materials

Section 6-09.2 is supplemented with the following:

Special Materials for Rapid Set Latex Modified Concrete

Cement shall be Rapid Set Cement as manufactured by CTS Cement Manufacturing Company of Cypress, CA at (800) 929-3030. The material shall be of recent manufacture (within the past 12 months) and shall be free of lumps.

Latex admixture shall be DOW Modifier A as manufactured by DOW Chemical Company of Midland, MI at (800) 447-4369, conforming to the material properties specified in Section 6-09.2 for latex admixture.

Food grade citric acid may be used as a retarder admixture.

Materials for Polyester Concrete

Polyester Resin Binder

The resin shall be an unsaturated isophthalic polyester-styrene co-polymer, and shall conform to the following requirements:

Viscosity:	75 to 200 cps (20 rpm at 77F)	ASTM	D	2196
Specific Gravity:	1.05 to 1.10 at 77F	ASTM	D	1475
Elongation:	35% minimum	ASTM	D	638
Tensile Strength:	2,500 psi minimum	ASTM	D	638
Conditioning:	18 hours/77F/50% + 5 hours/158F	ASTM	D	618

Silane Coupler: 1.0% minimum (by weight of polyester-styrene resin)

The silane coupler shall be an organosilane ester, gammamethacryloxypropyltrimethoxysilane. The promoter/hardeners shall be compatible with suitable methyl ethyl ketone peroxide (MEKP) and cumene hydroperoxide (CHP) initiators. MEKP initiators shall be used when the surrounding concrete temperatures are above 60F. A blend of initiators may be used as approved by the Engineer when the surrounding concrete temperature is 50F to 60F.

Polyester resin binder will be accepted based on submittal to the Engineer of a Manufacturer's Certificate of Compliance conforming to Section 1-06.3.

High Molecular Weight Methacrylate (HMWM) Resin

In addition to the viscosity and density properties, and the promoter/initiator system, already specified in this Section, the HMWM resin for polyester concrete overlays shall conform to the following requirements:

Flash Point: 180F minimum ASTM D 93

Tack-Free Time: 400 minutes maximum California Test 551

Prior to adding initiator, the HMWM resin shall have a maximum volatile content of 30 percent, when tested in conformance with ASTM D 2369.

HMWM resin will be accepted based on submittal to the Engineer of a Manufacturer's Certificate of Compliance conforming to Section 1-06.3.

Aggregate

The aggregate shall be from Washington State Pit Site B-335 located near Steilacoom, Washington and shall be thoroughly washed and kiln dried.

The aggregate shall conform to Section 9-03, and one of the following combined aggregate gradings:

Combined Aggregate			
	1/2" Max. Sieve Size	3/8" % Passing	Max. Passing
1/2"	100	100	
3/8"	83-100	100	
U.S. No. 4	65-82	62-85	
U.S. No. 8	45-64	45-67	
U.S. No. 16	27-48	29-50	
U.S. No. 30	12-30	16-36	
U.S. No. 50	6-17	5-20	
U.S. No. 100		0-7	0-7
U.S. No. 200		0-3	0-3

Aggregate retained on the U.S. No. 8 sieve shall have a maximum of 25 percent crushed particles. Fine aggregate shall consist of natural sand only.

Aggregate absorption shall not exceed one percent. The moisture content of the aggregate shall not exceed one half of the aggregate absorption at the time of

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
mixing with the polyester resin binder. The aggregate temperature shall be
between 45F and 100F at the time of mixing.

Sand for Abrasive Finish

The sand for abrasive finish shall conform to Section 6-09.2, and the aggregate
moisture content requirements specified above.

Construction Requirements

Equipment

Rotary Milling Machines

Section 6-09.3(1)B is supplemented with the following:

Rotary milling machines known to have the specified capacity conforming to
Standard Specification 6-09.3(1)B are: the CMI Roto-Mill PR-225, the CMI
Roto-Mill PR-275RT, and the Caterpillar PR-275.

Hydro-Demolition Machines

Section 6-09.3(1)C is supplemented with the following:

Possible sources of hydro-demolition machines include:

- 1. FLOW International, Inc.**
23500 64th Avenue S
Kent, WA 98032
(253) 850-3500
- 2. IVS Hydro-Demolition Services**
5460 Green Palms Street
Las Vegas, NV 89103
(800) 532-6790
- 3. Hydro-Technologies, Inc.**
6200 E Highway 62
Jeffersonville, IN 47130
(812) 284-9376
- 4. National Hydro, Inc.**
5643 Warner Road
Flowerville, MI 48836
(517) 223-0915

The Contractor may choose to use a machine from a source not listed above,
provided the machine is manufactured specifically for concrete removal and
meets the performance criteria specified in Section 6-09.3(1)C.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
Shot Blasting Machines

Section 6-09.3(1)D is supplemented with the following:

Possible sources of shot blasting machines include:

1. Humble Equipment Company

1720 Industrial Drive
P. O. Box 1606
Ruston, LA 71273-1606
(318) 251-1935

2. US Filter Blasttrac

6215 Aluma Valley Drive
Oklahoma City, OK 73121
(405) 478-3440

3. Texas Shot Blast

4040 Beckwood
San Antonio, TX 78259
(210) 497-5594

4. Shot Surfaces, Inc.

2630 SW Patton Road
Portland, OR 97201
(503) 796-9823

5. American Concrete Cutting

4600 Main Street
Springfield, OR 97478
(541) 726-8597

The Contractor may choose to use a machine from a source not listed above, provided the machine is manufactured specifically for concrete removal and meets the performance criteria specified in Section 6-09.3(1)D.

Section 6-09.3(1) is supplemented with the following:

Mobile Mixer for Polyester Concrete

The mixer shall be equipped to be calibrated to automatically proportion and blend all components of the specified mix on a continuous or intermittent basis as required by the finishing operation, and shall discharge mixed material directly into the finishing machine.

The mixer shall be equipped with a metering device that automatically measures and records the aggregate volumes and the corresponding resin volumes. The

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
metering device shall have a readout display gage visible at all times, and shall be capable of printing out the volumes being recorded for each material.

The aggregate and resin volumes shall be recorded at no greater than five minute intervals along with the date of each recording. A printout of the recordings shall be furnished to the Engineer at the end of each work shift.

The Contractor shall prevent any cleaning chemicals from reaching the polyester mix during the overlay applications.

Mobile Mixer for Latex Modified Concrete

Section 6-09.3(1)H is supplemented with the following:

The capacity of the mobile mixer and bulk material handling systems for rapid set latex modified concrete shall be six cubic yards per hour, minimum.

Submittals

Section 6-09.3(2) is supplemented with the following:

Submittals for Polyester Concrete

The Contractor shall submit the following items to the Engineer for approval in accordance with Section 6-01.9:

1. The type of shot blasting machine selected by the Contractor for use in this project to scarify concrete surfaces.
2. The method and materials used to contain, collect, and dispose of all concrete debris generated by the scarifying process, including provisions for protecting adjacent traffic from flying debris.
3. The qualifications of on-site supervisors, mobile mixer operators, and finishing machine operators, in accordance with Section 6-09.3(8) as supplemented in these Special Provisions.
4. The polyester concrete mix design in accordance with Section 6-09.3(3) as supplemented in these Special Provisions.
5. Samples, as specified below, shall be submitted to the Engineer at least 15 working days prior to placing the polyester overlay:
 - a. One gallon minimum of the polyester resin binder.
 - b. One pint minimum of the HMWM resin.
 - c. 100 pounds minimum of aggregate.
 - d. Representative samples from each lot of prepackaged deck repair material and aggregate extenders, if selected for use in this project, as specified in Section 6-09.3(3) as supplemented in these Special Provisions.
6. The method and materials used to contain HMWM resin and polyester concrete within the deck area specified to receive the overlay.
7. Details of the screed rail support system, including details of anchoring the rails and providing rail continuity.

The Contractor shall not begin scarifying operations until receiving the Engineer's approval of Items 1 and 2. The Contractor shall not begin placing

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
polyester concrete overlay until receiving the Engineer’s approval of Items 3 through 7.

Concrete Overlay Mixes

Section 6-09.3(3) is supplemented with the following:

The Contractor may use either fly ash modified concrete (FMC), latex modified concrete (LMC), or microsilica modified concrete (MMC) for the concrete overlay. The Contractor shall select one type of concrete for the overlay, provide a mix for the selected concrete to the Engineer in accordance with Item 5 of Section 6-09.3(2), and use that type for the total concrete overlay operation. Use of a combination of types will not be allowed.

Rapid Set Latex Modified Concrete

The Contractor shall use rapid set latex modified concrete for the total concrete overlay operation, in accordance with the following mix design. Use of latex modified concrete (LMC), fly ash modified concrete (FMC) or microsilica modified concrete (MMC) will not be allowed.

Rapid set latex modified concrete shall be a workable mix, uniform in composition and consistency. Mix proportions per cubic yard shall be as follows:

Rapid Set Cement 658 LB.
DOW Modifier A Latex Admixture 208 LB.
Fine Aggregate 1,700 LB.
Coarse Aggregate 1,300 LB.
Water 162 LB.
Air 4 to 7 percent

Polyester Concrete

The Contractor shall use polyester concrete for the total concrete overlay operation. Use of latex modified concrete (LMC), fly ash modified concrete (FMC) or microsilica modified concrete (MMC) will not be allowed.

Polyester concrete shall consist of the following three components – polyester resin binder, HMWM resin, and combined aggregate, in accordance with Section 6-09.2 as supplemented in these Special Provisions. The Contractor shall submit the mix design for the polyester concrete to the Engineer for approval. The mix design shall include a recommended initiator percentage for the expected application temperature. The polyester resin binder shall be approximately 12 percent by weight of the dry combined aggregate. The Contractor shall not begin the trial overlay of the polyester concrete, as specified in Section 6-09.3(8) as supplemented in these Special Provisions, until receiving the Engineer’s approval of the polyester concrete mix design.

The moisture content and water limit specifications for latex modified concrete in Section 6-09.3(3)E shall also apply.

Deck Repair Concrete for Polyester Concrete Overlays

Patching concrete for further deck preparation in accordance with Section 6-09.3(6) shall be the polyester concrete mix used for the overlay.

Storing and Handling

Section 6-09.3(4) is supplemented with the following:

Storing and Handling of Polyester Concrete Materials

All materials shall be delivered in their original containers bearing the manufacturer's label, specifying date of manufacturing, batch number, trade name brand, quantity, and mixing ratio. Each shipment of polyester resin binder and HMWM resin shall be accompanied by a Materials Safety Data Sheet (MSDS).

The material shall be stored to prevent damage by the elements and to ensure the preservation of their quality and fitness for the work. The storage space shall be kept clean and dry, and shall contain a high-low thermometer. The temperatures of the storage space shall not fall below nor rise above that recommended by the manufacturer. Every precaution shall be taken to avoid contact with flame.

Stored materials shall be inspected prior to their use, and shall meet the requirements of these Special Provisions at the time of use.

Any material which is rejected because of failure to meet the required tests or that has been damaged so as to cause rejections shall be immediately replaced at no additional expense to the Contracting Agency.

Sufficient material to perform the entire polyester concrete overlay application shall be in storage at the site prior to any field preparation, so that there shall be no delay in procuring the materials for each day's application.

Appropriate impermeable protective garments shall be used by all workers who may contact the resin or initiators to prevent skin contact. If skin contact occurs, the resin or initiators shall be immediately washed off. Clothing that becomes saturated with resin shall be removed immediately.

All personnel working with the polyester concrete shall be issued suitable approved organic vapor respirators in addition to other appropriate protection equipment.

Scarifying Concrete Surface

Section 6-09.3(5) is supplemented with the following:

The Contractor may use either a rotary milling machine, hydro-demolition machine, or shot blasting machine for scarifying concrete surfaces. The Contractor shall inform the Engineer of the type of machine selected in accordance with Item 1 of Section 6-09.3(2).

The scarification depth for all concrete decks receiving polyester concrete overlay shall be 1/4 inch, and all references to scarification depth in Sections 6-09.3(5)A and 6-09.3(5)B shall be revised accordingly.

Steel reinforcing bars used in deck repair operations, in accordance with Sections 6-09.3(5)F and 6-09.3(6)B, shall be epoxy-coated in accordance with Section 6-02.3(24)H.

Further Deck Preparation

Placing Deck Repair Concrete

Section 6-09.3(6)C is supplemented with the following:

Patching concrete for bridge decks receiving rapid set latex modified concrete overlay shall be rapid set latex modified concrete only. Concrete Class M shall not be used.

Placing Patching Concrete For Polyester Concrete Overlay

Patching concrete shall be polyester concrete, as specified in Section 6-09.3(3) as supplemented in these Special Provisions. Concrete Class M shall not be used.

Polyester concrete for deck repair shall be placed and cured in accordance with Sections 6-09.3(11) and 6-09.3(13), respectively, as supplemented in these Special Provisions.

All deck repair material that fails to achieve a minimum compressive strength of 3,000 psi in six hours as verified by the rebound number determined in accordance with ASTM C 805 shall be removed and replaced with new deck repair material by the Contractor, at no additional expense to the Contracting Agency.

Quality Assurance

Section 6-09.3(8) is supplemented with the following:

Rapid set latex modified concrete

Quality assurance for all rapid set latex modified concrete work shall conform to Section 6-09.3(8)B, and the following:

Rapid set latex modified concrete will not be tested for slump.

The Contractor shall make arrangements to have a qualified technical representative of CTS Cement Manufacturing Company present at the bridge site throughout all rapid set latex modified concrete overlay work, including surface preparation, mixing, placing, screeding, and curing. The qualified technical representative shall be an employee of CTS Cement Manufacturing Company.

The Contractor shall submit the name, current phone number, and experience qualifications of the qualified technical representative of CTS Cement Manufacturing Company to the Engineer for approval, along with the other submittals specified in Section 6-09.3(2). The submittal shall include a listing of the rapid set latex modified concrete overlay project on which the individual has served as a qualified technical representative, and shall include a description of the project, the name of the project's Owner or Contracting Agency, and the name and current phone number of the project's Owner's or Contracting Agency's contact person.

The Contractor shall not begin rapid set latex modified concrete operations until receiving the Engineer's approval of the qualified technical representative submittal.

All recommendations made by the qualified technical representative, and approved by the Engineer, shall be adhered to by the Contractor.

Rapid Set Latex Modified Concrete Trial Overlay

The Contractor shall place a trial overlay of rapid set latex modified concrete using the equipment selected by the Contractor and the production mix and procedure specified in Section 6-09.3 as supplemented in these Special

Provisions. The Contractor shall notify the Engineer of the time and location of the trial overlay at least seven calendar days prior to the scheduled trial overlay.

The trial overlay shall be placed on a previously cast and cured concrete pad at a location selected by the Contractor. The plan area of the concrete pad shall be 12 feet minimum in width and 15 feet minimum in length.

The Contractor shall clean the concrete pad surface, mix, place, finish, and cure the rapid set latex modified concrete overlay, and check the trial overlay for bond, in accordance with Section 6-09.3 as supplemented in these Special Provisions, except as otherwise noted. The Contractor need not scarify the concrete surface and perform further deck preparation on the concrete pad surface provided that all other conditions of Section 6-09.3(7) are satisfied. The trial overlay shall be 12 feet wide, 15 feet long, and 1-1/2 inches thick.

The Contractor shall not begin construction operations at the bridge site receiving the rapid set latex modified concrete overlay until receiving the Engineer's approval of the completed trial overlay.

After receiving the Engineer's approval of the completed trial overlay, the concrete pad and trial overlay shall become the Contractor's property and shall be removed and disposed of in accordance with Section 2-02.3.

Quality Assurance For Polyester Concrete Overlay

The Contractor shall arrange to have the suppliers of the polyester resin binder and HMWM resin furnish technical service relating to application of material and health and safety training for personnel who are to handle the polyester concrete and the HMWM resin prime coat.

On-site supervisors, and all personnel operating the mobile mixer and finishing machines, shall have successful previous experience in mixing and placing polyester concrete overlay. Documentation of project experience with polyester concrete overlay shall include the name and location of the project, the Contracting Agency of the project, the area quantity of overlay placed, and the name and current phone number of the Contracting Agency's contact person for the referenced project.

Polyester Concrete Trial Overlay

The Contractor shall place a trial overlay of polyester concrete using the equipment selected by the Contractor and the production mix and procedure as approved by the Engineer in accordance with Section 6-09.3(3). The Contractor shall notify the Engineer of the time and location of the trial overlay at least seven calendar days prior to the scheduled trial overlay.

The trial overlay shall be placed on a previously cast and cured concrete pad at a location selected by the Contractor. The plan area of the concrete pad shall be 12 feet minimum in width and 15 feet minimum in length.

The Contractor shall clean the concrete pad surface, mix, place, finish, and cure the polyester concrete overlay, and check the trial overlay for bond, in accordance with Section 6-09.3 as supplemented in these Special Provisions, except as otherwise noted. The Contractor need not scarify the concrete surface and perform further deck preparation on the concrete pad surface provided that all other conditions of Section 6-09.3(7) are satisfied. The trial overlay shall be 12 feet wide, 15 feet long, and 3/4 inches thick.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

The Contractor shall perform three pull-off tests on the trial overlay in accordance with American Concrete Institute 503R - Appendix A. The Contractor shall record the pull-off test results and the amount of (if any) failure into the base concrete, and shall provide written documentation of the test results to the Engineer.

The Contractor shall not begin placing polyester concrete overlay at the bridge site(s) receiving the polyester concrete overlay until receiving the Engineer's approval of the completed trial overlay.

After receiving the Engineer's approval of the completed trial overlay, the concrete pad and trial overlay shall become the Contractor's property and shall be removed and disposed of in accordance with Section 2-02.3.

Mixing Concrete for Concrete Overlay

Section 6-09.3(9) is supplemented with the following:

Mixing of concrete for rapid set latex modified concrete work shall conform to Section 6-09.3(9)B, and the following:

If food grade citric acid is used as a retarder, it shall be mixed into a solution with water. The solution shall not be added directly to the latex admixture. The solution shall be added to a separate admixture tank for dispensing into the rapid set latex modified overlay mix.

Mixing Polyester Concrete

Polyester concrete shall be mixed in mobile mixers conforming to Section 6-09.3(1) as supplemented in these Special Provisions, and in accordance with the mix design approved by the Engineer.

The polyester resin binder in the polyester concrete shall be approximately 12 percent by weight of the dry aggregate. The Contractor shall determine the exact percentage as approved by the Engineer.

The amount of peroxide initiator used shall result in a polyester concrete set time between 30 and 120 minutes during placement as determined by California Test 551, Part 2, "Method of Test For Determination of Set Time of Concrete Overlay and Patching Materials", by Gilmore Needles. Accelerators or inhibitors may be required as recommended by the polyester resin binder supplier and as approved by the Engineer.

The polyester resin binder shall be initiated and thoroughly blended just prior to mixing the aggregate and binder. The polyester concrete shall be thoroughly mixed prior to placing.

Overlay Profile and Screed Rails

Section 6-09.3(10) is supplemented with the following:

The minimum thickness of polyester concrete overlay shall be 3/4 inches, except as otherwise shown in the Plans or adjusted by the Engineer.

Placing Concrete Overlay

Section 6-09.3(11) is supplemented with the following:

Placing Rapid Set Latex Modified Concrete Overlay

Placing rapid set latex modified concrete overlay shall conform to all requirements of this section, including those specific for latex modified concrete overlay, except as otherwise noted.

After the lane or strip to be overlaid with rapid set latex modified concrete overlay has been prepared and immediately before placing the concrete, it shall be thoroughly soaked and kept continuously wet with water for a minimum period of two hours prior to placement of the concrete.

The allowable temperature range of the concrete deck receiving the rapid set latex modified concrete shall be between 45F and 70F.

The Contractor shall conform to the transverse bulkhead placement requirements whenever rapid set latex modified concrete placement is stopped for a period of 20 minutes or more. Further placement is permitted only after a period of 24 hours unless a gap is left in the lane or strip.

Rapid set latex modified concrete shall not be placed against the edge of an adjacent lane or strip that is less than four hours old.

Placing Polyester Concrete Overlay

Application of the HMWM prime coat and the polyester concrete overlay shall not begin if rain is expected. The area receiving the prime coat shall be dry and had no rain for at least 24 hours. Immediately prior to applying the prime coat, the surface receiving the prime coat shall be swept clean by compressed air to remove accumulated dust and any other loose material.

The concrete bridge deck surface temperature shall be between 50F and 100F when the prime coat is applied.

The prepared concrete surface shall receive one coat of promoted/initiated wax-free HMWM resin. The promoted/initiated HMWM resin primer shall be worked into the concrete in a manner to effect complete coverage of the area. A one pint sample of each batch of promoted/initiated HMWM resin shall be retained and submitted to the Engineer at the time of primer application to verify proper catalyzation. Under no circumstances shall any resin be allowed to run into drains and expansion joints, or otherwise escape the Contractor's collection and containment system.

If the HMWM primed surface becomes contaminated, the contaminated area shall be cleaned by abrasive blasting and reprimed at no additional expense to the Contracting Agency.

The HMWM prime coat shall cure for a minimum of 30 minutes before placing the polyester concrete overlay. Placement of the polymer concrete shall not proceed until the Engineer verifies that the HMWM resin was properly promoted and initiated, as evidenced by the HMWM batch sample.

The polyester concrete shall be placed on the liquid or hardened HMWM prime coat within two hours of placing the prime coat. Polyester concrete shall be placed prior to gelling and within 15 minutes following initiation, whichever occurs first. Polyester concrete that is not placed within this time shall be discarded.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

If, for any reason, polyester concrete is not placed over the prime coat within the two hour time limit, the Contractor shall apply a fresh coat of HMVM resin primer immediately followed by an abrasive sand finish coating. The abrasive sand finish shall be broadcast onto the surface to affect a uniform coverage of a minimum of 0.8 pounds per square yard. Prior to applying the polyester concrete overlay, the surface shall be re-cleaned in accordance with Section 6-09.3(7).

Expansion joints shall be adequately isolated prior to placing the overlay as approved by the Engineer. Saw cutting at bridge expansion joints will not be allowed.

The surface temperature of the area receiving the polyester concrete shall be the same as specified above for the HMWM prime coat.

The polyester concrete shall be consolidated to a relative compaction of not less than 97 percent.

Finishing Concrete Overlay

Section 6-09.3(12) is supplemented with the following:

Neither latex admixture nor water shall be applied to the surface of the rapid set latex modified concrete overlay to assist in finishing the top surface.

Finishing Polyester Concrete Overlay

The finished surface of the polyester concrete overlay shall conform to Section 6-02.3(10).

The polyester concrete shall be struck off to the established grade and cross section and consolidated to the required compaction. Forms shall be coated with suitable bond release agent to permit ready release of forms.

The Contractor shall texture the overlay surface by combing in accordance with Section 6-02.3(10) except as otherwise specified. The texture shall be applied immediately behind the finishing machine. The tine spacing shall be approximately one inch.

The polyester concrete overlay shall receive an abrasive sand finish. The sand finish shall be applied immediately after overlay strike-off and before gelling occurs.

The surface texture of polyester concrete surface shall be uniform and shall have a friction number of not less than 35 as determined by ASTM E 274.

After initial finishing, the polyester overlay may require grinding of rough areas as determined by the Engineer. The grinding shall be done in a manner that will not damage the existing bridge deck. Rotary milling machines are not allowed.

The Contractor shall demonstrate to the satisfaction of the Engineer that the method and equipment for grinding the polyester overlay are adequate for the intended purpose and will provide satisfactory results. The removal shall not commence until the Contractor receives the Engineer's approval of the grinding equipment.

The bridge deck areas specified by the Engineer to receive grinding shall be ground in a longitudinal direction. The grinding equipment shall use diamond tipped saw blades mounted on a power driven, self-propelled machine that is specifically designed to texture concrete surfaces. The grinding equipment shall

have a blade spacing to provide grooves that are between 0.10 and 0.15 inches wide. The land area between the grooves shall be approximately 0.125 inches.

The Contractor shall contain, collect, and dispose of all concrete debris generated by the grinding operation in accordance with Item 2 of the polyester concrete submittal in Section 6-09.3(2) as supplemented in these Special Provisions.

Prior to opening the overlay area to vehicular traffic the finished overlay shall be power swept to remove excess loose aggregate and abrasive sand. The Contractor shall demonstrate to the satisfaction of the Engineer that the power broom equipment will not damage the finished overlay. Any damage to the finished overlay caused by the power broom shall be repaired at no additional expense to the Contracting Agency.

Curing Concrete Overlay

Section 6-09.3(13) is supplemented with the following:

Special Curing Requirements For Rapid Set Latex Modified Concrete

Once in place the burlap shall be lightly fog sprayed with water. A separate layer of white, reflective type polyethylene sheeting shall immediately be placed over the wet burlap. The concrete shall then be wet cured by keeping the burlap wet until the concrete reaches the specified minimum compressive strength for traffic load of 3,000 psi. Upon reaching the specified minimum compressive strength for traffic load, the polyethylene sheeting shall be removed and the bridge opened to traffic.

Curing Polyester Concrete

Traffic and equipment shall not be permitted on the polyester overlay for at least four hours and until the polyester overlay has reached a minimum compressive strength of 3,000 psi as verified by the rebound number determined in accordance with ASTM C 805.

Areas in the polyester concrete that do not totally cure, or that fail to attain the minimum compressive strength specified above, shall be removed and replaced with new polyester concrete material by the Contractor, at no additional expense to the Contracting Agency.

Checking For Bond

Section 6-09.3(14) is supplemented with the following:

Checking Polyester Concrete For Bond

After the requirements for curing have been met, the entire overlaid surface shall be sounded by the Contractor, in a manner approved by and in the presence of the Engineer, to ensure total bond of the concrete to the bridge deck. Polyester concrete in unbonded areas shall be removed and replaced with polyester concrete by the Contractor, at no additional expense to the Contracting Agency.

All cracks, except those that are significant enough to require removal as determined by the Engineer, shall be thoroughly filled and sealed with HMWM resin. Cracks 1/16 inch and greater in width shall receive two applications of HMWM resin. Immediately following the application of HMWM resin, the wetted surface shall be coated with sand for abrasive finish.

6-10, CONCRETE BARRIER

Construction Requirements

Cast-In-Place Concrete Barrier

Section 6-10.3(2) is supplemented with the following:

*** Concrete *** barrier shall be constructed in accordance with the requirements for cast-in-place concrete barrier, and shall be cured and finished in accordance with Sections 6-02.3(11)A and 6-02.3(14) respectively.

Temporary Concrete Barrier

Section 6-10.3(5) is supplemented with the following:

Delineators shall be placed on the traffic face of the barrier 6 inches from the top and spaced a maximum of 40 feet on tangents and 20 feet through curves.

Reflector color shall be white on the right of traffic and yellow on the left of traffic.

The Design-Builder shall maintain, replace, and clean the delineators when ordered by WSDOT.

The minimum allowable shy distance from the center of the edge line to the nearest edge of the concrete barrier shall be two feet unless otherwise specified in the Plans or in an Engineer-approved traffic control plan.

Exposed ends of temporary concrete barrier shall be protected using an Engineer-approved method or be located outside the clear zone and adequately flared at an 18:1 taper for a 70 mph speed, 17:1 taper for a 65 mph speed, 16:1 for a 60 mph speed, a 14:1 taper for a 55 mph speed, and 10:1 taper for a 40 mph speed.

6-12, NOISE BARRIER WALLS

Materials

Section 6-12.2 is supplemented with the following:

Precast Concrete Noise Barrier Walls

Grout for encapsulating dowel bars shall conform to Section 6-02.3(26)H.

Grout pads at the bases of precast concrete panels shall conform to Section 6-02.3(20).

Base plates and anchor bolt templates shall conform to ASTM A 36. Base plates shall be corrosion protected by one of the following methods:

1. One coat of Formula A-11-99 paint as specified in Sections 9-08.2 and 6-07.3(5).
2. Galvanized after fabrication in accordance with AASHTO M 111.
3. Galvanized after fabrication in accordance with AASHTO M 298, Class 5, Type 1.

Anchor rods, nuts, and washers shall conform to Section 9-06.5(1), except that plate washers conforming to ASTM A 36 may be used. Nuts and washers, and a minimum

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
of 1'-0" of the exposed end of the anchor rod, shall be corrosion protected by one of the following methods:

1. One coat of Formula A-11-99 paint as specified in Sections 9-08.2 and 6-07.3(5).
2. Galvanized after fabrication in accordance with AASHTO M 232.
3. Galvanized after fabrication in accordance with AASHTO M 298, Class 5, Type 1.

The button head end, 1'-0" minimum, of steel reinforcing Bar B, as identified in the Standard Plans, shall be painted with one coat of Formula A-11-99, as specified in Sections 9-08.2 and 6-07.3(5).

The sealant system for the vertical joint between precast concrete panels shall consist of a single component, gun grade, polyurethane sealant, with a closed cell polyurethane foam backer rod.

Masonry Noise Barrier Walls

Concrete masonry units (CMU's) shall conform to ASTM C 90, Grade N, Type 1. Concrete masonry units shall have a density between 100 and 115 pounds per cubic foot. Shrinkage shall not exceed 0.065 percent.

CMU's will be accepted based on submittal to WSDOT of a Manufacturer's Certificate of Compliance conforming to Section 1-06.3. The Manufacturer's Certificate of Compliance shall include test results, conducted within the previous twelve months, as required to document compliance with the material requirements specified in these Special Provisions.

The concrete masonry unit faces shall be nominal 8 by 16 inches with thicknesses as specified in the Plans. Concrete masonry unit surface texture and color shall meet the requirements of the I-405 Urban Design Criteria for Kirkland Stage 1.

Special shapes shall be provided to complete the work as specified in the Plans.

The Design-Builder shall submit four samples of each type of concrete masonry unit block specified for use on the project to WSDOT for approval.

Grout for concrete masonry units shall conform to ASTM C 476 for fine grout, with a six sack maximum mix and 3/8" aggregate. The grout shall have a minimum 28 day compressive strength of 2,000 psi and a slump of ten inches.

Mortar for concrete masonry units shall conform to ASTM C 270, Type S. The color shall be natural gray. The Design-Builder shall mix the mortar in a mechanical mixer of one sack minimum capacity for a minimum of three minutes after all materials have been added before using the mortar.

Masonry sealer shall be selected from one of the following:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

1. Baracade Silane 40, manufactured by Tamms.
2. Masterseal SL40 VOC, manufactured by Master Builders.
3. Masterseal 340, manufactured by Master Builders.
4. Siloxane/Silane 20%, manufactured by Symons.

The Design-Builder shall submit two copies of the manufacturer's recommended masonry sealer application procedure to WSDOT for approval.

The parge coating applied to the top of the masonry wall shall be a waterproof cement-base coating selected from one of the following:

1. Masterseal 150, manufactured by Master Builders.
2. Brushbond, manufactured by Chemrex.
3. Tamoseal, manufactured by Tamms.

The sealant system for the vertical expansion joints shall consist of a single component, gun grade, polyurethane sealant, with a closed cell polyurethane foam backer rod.

Noise Barrier Wall Access Door

Access door frames shall be formed of 16 gauge steel to size and dimensions shown in the Plans. The access door frame head and jamb members shall be mitered, securely welded, and ground smooth. Each head shall have two anchors and each jamb shall have three anchors. The hinges shall be reinforced with 1/4 inch by 12 inch plate, width equal to the full inside width of the frame.

Access doors shall be full flush 1-3/4 inch thick seamless doors with a honeycomb core. Door faces shall be constructed with smooth seamless 18 gauge roller-levered, cold-rolled steel sheet. The vertical edges shall be neat interlocked hemmed edge seam. The top and bottom of the door shall be enclosed with 16 gauge channels. Mortise and reinforcement for locks and hinges shall be 10 gauge steel.

Each access door shall have three hinges. Access door hinges shall be stainless steel, 4-1/2 inches square, with stainless steel ball bearing and non-removable pins.

Each access door shall have two pull plates. The pull plates shall be stainless steel, with a grip handle of one inch diameter and 8 to 10 inches in length.

Access door deadbolt locks shall be capable of accepting a Best CX series core. The Design-Builder shall furnish and install a spring loaded construction core lock with each lock. WSDOT will furnish the permanent Best CX series core for the Design-Builder to install at the conclusion of the project.

Paint for exposed metal surfaces of access doors and frames, except for stainless steel surfaces, shall be Exterior Acrylic water base paint conforming to Federal Standard No. TT-P-19. The paint color, when dry, shall meet the requirements of the *I-405 Urban Design Criteria for Kirkland Stage 1*. Color chips are available from the source specified in Section 9-08.4(7).

Construction Requirements

Precast Concrete Panel Fabrication and Erection

Section 6-12.3(6) is supplemented with the following:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

The Design-Builder shall form a finish meeting the requirements of the *I-405 Urban Design Criteria for Kirkland Stage 1*, as specified in the Plans and Section 6-02.3(14) as supplemented in these Special Provisions, on the surface of the precast concrete panel facing the traffic side.

The Design-Builder shall form a finish meeting the requirements of the *I-405 Urban Design Criteria for Kirkland Stage 1*, as specified in the Plans and Section 6-02.3(14) as supplemented in these Special Provisions, on the surface of the precast concrete panel facing the residential area, except as otherwise noted. The surfaces of the pilaster shall receive either a Class 2 surface finish in accordance with Section 6-02.3(14)B, if pigmented sealer is being applied, or a Class 1 surface finish in accordance with Section 6-02.3(14)A, if pigmented sealer is not being applied.

Masonry Wall Construction

Section 6-12.3(7) is supplemented with the following:

Masonry Wall Workmanship

The Design-Builder shall construct the masonry wall in accordance with the standards of masonry installation specified in Chapter 21 of the current Uniform Building Code.

All masonry wall construction workers shall be thoroughly trained and experienced in the necessary crafts, shall be completely familiar with the specified requirements and methods needed for proper completion of the work, and shall be supervised at the construction site at all times by the supervising journeyman masons as approved by WSDOT.

Sample Masonry Wall Panel

The Design-Builder shall demonstrate workmanship by constructing a 48 inch by 48 inch sample panel of each type of masonry wall for WSDOT's approval. The sample panel shall be constructed by the supervising journeyman mason specified by the Design-Builder and as approved by WSDOT. The sample panel shall show the general construction and appearance of the installed concrete masonry units. The Design-Builder shall submit the sample panel to WSDOT for approval, and shall not proceed with masonry wall construction until receiving WSDOT's approval of the sample panel. The Design-Builder shall construct the sample panel on a transportable platform, and shall relocate the sample panel as directed by WSDOT as construction progresses.

If any of the supervising journeyman masons are replaced during the project, each replacement supervising journeyman mason shall construct another sample panel as a requirement for being approved by WSDOT for the supervising position.

The Design-Builder shall construct all masonry walls in accordance with the quality of the sample panel approved by WSDOT. All masonry wall construction not consistent with the quality of the approved sample panel shall be reconstructed by the Design-Builder at no additional cost to the Contracting Agency.

The Design-Builder shall maintain the sample panel at the project site until all the noise barrier walls are approved and accepted by WSDOT, at which time all

sample panels shall become the property of the Design-Builder and shall be disposed of in accordance with Section 2-02.3.

General Requirements

All masonry materials stored on the project site shall be stored off the ground and protected from weather. Concrete masonry units that are chipped, cracked, or spalled on the faces or edges shall not be used.

The Design-Builder shall lay up all walls in running bond, unless otherwise shown in the Plans, and all walls shall be plumb, level, and true to the lines and dimensions as shown in the Plans. All head and bed joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells.

Mortar

Mortar joints shall be of uniform thickness, ½ inch maximum. The Design-Builder shall not change coursing or bonding after beginning work on a wall. The Design-Builder shall tool all joints flush with adjacent surfaces to a dense brushed finish. The split face side of wall shall have a concave smooth joint. The scored split faces shall have a rake joint to match the depth of the scores.

Temperature

When air temperatures fall below 40F, grout mixing water and aggregate shall be heated to produce a grout temperature between 40F and 120F. While grouting the concrete masonry units, and for at least 24 hours after grouting the units, the Design-Builder shall maintain the temperature of the concrete masonry units above freezing. When atmospheric temperatures fall below 20F, the Design-Builder shall erect enclosures around the concrete masonry units being grouted, and shall maintain the enclosures for at least 24 hours after grouting the units.

The Design-Builder shall not perform masonry wall work when the air temperature is below 40F on a falling thermometer, or when it is likely that the temperature will fall below 40F before the mortar has set, except when appropriate provisions have been made to heat and enclose the concrete masonry units and the work area as approved by WSDOT. The Design-Builder may begin masonry wall work at 34F on a rising thermometer.

Grouting Cells

Cells with steel reinforcing bars shall be grouted solid and compacted. Vertical cells with steel reinforcing bars shall be aligned and filled to provide a continuous unobstructed opening of the dimensions indicated, but in no case less than two inches by three inches. The Design-Builder shall provide cleanout openings at the bottom of all cells to be filled at each stage of grout placement where the height of grout placement is greater than four feet. The Design-Builder shall remove all overhanging mortar and other obstructions and debris from the insides of the cells being grouted. The Design-Builder shall seal all cleanouts, after WSDOT has inspected and approved the cells. The Design-Builder shall place grout in lifts of eight feet or less.

Top Course

The Design-Builder shall cover the tops of all exposed walls not being worked on with a waterproof membrane, secured in place. All unfinished work shall be stepped back for joining to new work. Toothing shall not be performed.

The top course shall be a solid grouted bond beam unit. The Design-Builder shall apply a parge coat to the top of the wall.

Cleaning Exposed Surfaces

The Design-Builder shall clean all exposed masonry at the end of each day's work. After final pointing, the Design-Builder shall remove all mortar spots and droppings. The Design-Builder shall cut out all defective joints and repoint the joints solidly with mortar. The Design-Builder shall protect all work from damage, stain, and discoloring.

The Design-Builder shall perform additional final cleaning prior to applying the pigmented sealer. The Design-Builder shall remove all large particles of mortar before wetting the wall. The Design-Builder shall saturate the concrete masonry units with clean water and shall flush all loose mortar and dirt from the wall surface. The Design-Builder shall scrub the wall surface with a stiff brush and a masonry cleaning solution, in accordance with the cleaning solution manufacturer's instructions. The Design-Builder shall thoroughly wash the wall surface of all cleaning solution, dirt, and mortar crumbs with clean pressurized water. The Design-Builder shall not use acid cleaning solutions to clean the wall surface. The Design-Builder shall protect all wall surfaces adjacent to the sections of wall being cleaned.

Masonry Sealer

All exposed masonry surfaces shall receive two coats of masonry sealer, applied to one foot below finish ground line, from one of the masonry sealer products specified in Section 6-12.2 as supplemented in these Special Provisions. The masonry sealer shall be applied in accordance with the manufacturer's recommendations.

6-13, STRUCTURAL EARTH WALLS

Materials

Section 6-13.2 is supplemented with the following:

Welded Wire Faced Structural Earth Wall Materials

Welded Wire Mats and Backing Mats

Welded wire fabric for welded wire mats and backing mats shall conform to AASHTO M 32, and shall be fabricated from smooth wire fabric conforming to AASHTO M 55.

Welded wire fabric wire size for backing mats shall be W2.1 minimum for wall face backing layers of 1'-6" maximum thickness, and shall be W2.9 minimum for wall face backing layers between 1'-6" and 2'-0". The minimum clear opening dimension of the backing mat shall not exceed the minimum particle size of the wall facing backfill as specified below.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Welded wire fabric for welded wire mats and backing mats shall be galvanized after fabrication in accordance with ASTM A 641 (two ounces minimum per square foot). All damage to the galvanizing shall be repaired with one coat of Formula A-9-73 paint conforming to Section 9-08.2.

Construction Geotextile for Wall Facing

Construction geotextile for wall facing shall conform to the requirements in Section 9-33.1 for Construction Geotextile for Underground Drainage, Moderate Survivability, Class A.

Backfill for Welded Wire Faced Structural Earth Wall

All backfill material within the structural earth wall reinforced zone shall be free draining, free from organic or otherwise deleterious material.

Backfill material within the reinforced zone, except for the wall facing backfill placed immediately behind the wall face, as shown in the Plans and the structural earth wall working drawings as approved by WSDOT, shall conform to Section 9-03.14(1).

The coarse, granular material used for the wall facing backfill placed immediately behind the wall face, as shown in the Plans, shall conform to the following gradation requirements:

1. The minimum particle size shall be no less than the width of the minimum opening dimension in the backing mat.
2. The maximum particle size shall be no greater than six inches.

All material within the structural earth wall reinforced zone shall be substantially free of shale or other soft, poor durability particles, and shall not contain recycled materials, such as glass, shredded tires, portland cement concrete rubble, or asphaltic concrete rubble. The material shall meet the following aggregate durability requirements:

Property	Test Method	Allowable Test Value
Los Angeles Wear,	AASHTO T 96	35 percent max.
500 rev.		
Degradation	WSDOT Test Method 113	15 percent min.

All material within the structural earth wall reinforced zone shall meet the following chemical requirements:

Property	Test Method	Allowable Test Value
Resistivity	AASHTO T 288	3,000 ohm-cm, min.
pH	AASHTO T 289	5 to 10
Chlorides	AASHTO T 291	100 ppm max.
Sulfates	AASHTO T 290	200 ppm max.

If the resistivity of the backfill material equals or exceeds 5,000 ohm-cm, the specified chloride and sulfate limits may be waived.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
Precast Concrete Panel Faced Structural Earth Wall Materials

General Materials

Concrete Leveling Pad

Leveling pad concrete shall be commercial concrete in accordance with Section 6-02.3(2)B.

Backfill for Precast Concrete Panel Faced Structural Earth Wall

All backfill material within the structural earth wall reinforced zone shall be free draining, free from organic or otherwise deleterious material.

Backfill material within the reinforced zone shall conform to Section 9-03.14(1), except that the maximum particle size for walls with geogrid reinforcement shall not exceed 1-1/4 inches.

All material within the structural earth wall reinforced zone shall be substantially free of shale or other soft, poor durability particles, and shall not contain recycled materials, such as glass, shredded tires, portland cement concrete rubble, or asphaltic concrete rubble. The material shall meet the following aggregate durability requirements:

Property	Test Method	Allowable Test Value
Los Angeles Wear,	AASHTO T 96	35 percent max.
500 rev.		
Degradation	WSDOT Test Method 113	15 percent min.

For walls with metallic soil reinforcement, all material within the structural earth wall reinforced zone shall meet the following chemical requirements:

Property	Test Method	Allowable Test Value
Resistivity	AASHTO T 288	3,000 ohm-cm, min.
pH	AASHTO T 289	5 to 10
Chlorides	AASHTO T 291	100 ppm max.
Sulfates	AASHTO T 290	200 ppm max.

If the resistivity of the backfill material equals or exceeds 5,000 ohm-cm, the specified chloride and sulfate limits may be waived.

For walls with geogrid soil reinforcement, all material within the structural earth wall reinforced zone shall meet the following chemical requirements:

Property	Test Method	Allowable Test Value
pH	AASHTO T 289	4.5 to 9

Wall backfill material satisfying these gradation, durability, and chemical requirements shall be classified as nonaggressive.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
Proprietary Materials

ARES Modular Panel Wall System

Geogrid reinforcement shall conform to Section 9-33.1 and shall be the following products conforming to the specified material properties:

Geogrid	Wide Width	^{1,2} Long Term
Product Name	Tensile Strength	Tensile Strength, T _{al}
Tensar UX1600HS	8,980 lb./ft. min.	2,640 lb./ft.
Tensar UX1700HS	10,830 lb./ft. min.	3,280 lb./ft.

¹These long term tensile strength requirements apply only in the geogrid direction perpendicular to the wall face.

²T_{al} shall be determined in accordance with WSDOT Standard Practice T 925, “Determination of Long-Term Strength for Geosynthetic Reinforcement”.

The wide width tensile strength of the geogrid shall be a minimum average roll value (the average test results for any sampled roll in a lot shall meet or exceed the values shown in the table). The strength shall be determined in accordance with ASTM D 6637 for multi-rib specimens.

The ultraviolet (UV) radiation stability, ASTM D 4355, shall be a minimum of 70 percent strength retained after 400 hours in the weatherometer.

The longitudinal (i.e., in the direction of loading) and transverse (i.e., parallel to the wall or slope face) ribs that make up the geogrid shall be perpendicular to one another. The maximum deviation of the cross-rib from being perpendicular to the longitudinal rib (skew) shall be no more than 1 inch in 5 feet of geogrid width. The maximum deviation of the cross-rib at any point from a line perpendicular to the longitudinal ribs located at the cross-rib (bow) shall be 0.5 inches.

The geogrid shall not exhibit brittle fracture (snapping, or rapid crack development), when tested in accordance with Test Method WSDOT T 926.

WSDOT will take random samples of the geogrid materials at the job site. Approval of the geogrid materials will be based on testing of samples from each lot. A “lot” shall be defined as all geogrid rolls sent to the project site produced by the same manufacturer during a continuous period of production at the same manufacturing plant having the same product name. The Contracting Agency will require 14 calendar days maximum for testing the samples after their arrival at the WSDOT Materials Laboratory in Tumwater, WA.

The geogrid samples will be tested for conformance to the specified material properties. If the test results indicate that the geogrid lot does not meet the specified properties, the roll or rolls which were samples will be rejected. Two additional rolls for each roll tested which failed from the lot previously tested will then be selected at random by WSDOT for sampling and retesting. If the retesting shows that any of the additional rolls tested do not meet the specified properties, the entire lot will be rejected. If the test results from all

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
the rolls retested meet the specified properties, the entire lot minus the roll(s) which failed will be accepted.

All geogrid materials which have defects, deterioration, or damage, as determined by WSDOT, will be rejected. All rejected geogrid materials shall be replaced at no expense to the Contracting Agency.

Except as otherwise noted, geogrid identification, storage and handling shall conform to the requirements specified in Section 2-12.2. The geogrid materials shall not be exposed to temperatures less than -20F and greater than 122F.

Rubber bearing pads shall be a type and grade as recommended by Tensar Earth Technologies, Inc.

Geosynthetic joint cover for all horizontal and vertical joints shall be a non-woven geosynthetic as recommended by Tensar Earth Technologies, Inc. Adhesive used to attach the geosynthetic to the rear of the precast concrete facing panel shall be as recommended by Tensar Earth Technologies, Inc.

MSE Plus Wall

Pins connecting the reinforcing mesh to the precast concrete panels shall conform to AASHTO M 32 and shall be galvanized in accordance with AASHTO M 111. Damage to the galvanizing shall be repaired with one coat of Formula A-9-73 paint conforming to Section 9-08.2.

Bearing pads shall be serrated high-density polyethylene (HDPE) copolymer pads with a Shore Hardness between 55 and 65.

Filter fabric joint cover for all horizontal and vertical joints shall be non-woven geosynthetic conforming to AASTHO M 288. Adhesive used to attach the geosynthetic to the rear of the precast concrete facing panel shall be as recommended by SSL, LLC.

Reinforced Earth Wall

Reinforcing strips shall be shop fabricated from hot rolled steel conforming to ASTM A 572 Grade 65 or approved equal, and shall be galvanized after fabrication in accordance with AASHTO M 111. Damage to the galvanizing shall be repaired with one coat of Formula A-9-73 paint conforming to Section 9-08.2.

Bolts and nuts shall conform to Section 9-06.5(3), and shall be galvanized in accordance with AASHTO M 232.

Rubber bearing pads shall be a type and grade as recommended by the Reinforced Earth Company.

Vertical joint filler between panels, when specified in the structural earth wall working drawings, shall be two inch square, flexible open cell polyether foam strips, Grade UU-34, as recommended by the Reinforced Earth Company.

Filter fabric joint cover for all horizontal and vertical joints, when specified in the structural earth wall working drawings, shall be a pervious woven polypropylene filter fabric as recommended by the Reinforced Earth Company. Adhesive used to attach the fabric material to the rear of the

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
precast concrete facing panel shall be as recommended by the Reinforced Earth Company.

Reinforced Soil Wall

Reinforcing mesh shall be shop fabricated of cold drawn steel wire conforming to AASHTO M 32, and shall be welded into finished mesh fabric conforming to AASHTO M 55. Reinforcing mesh shall be galvanized after fabrication in accordance with AASHTO M 111. Damage to the galvanizing shall be repaired with one coat of Formula A-9-73 paint conforming to Section 9-08.2.

Retained Earth Wall

Tie strips shall be shop fabricated from hot rolled steel conforming to ASTM A 570 Grade 50 or approved equal, and shall be galvanized after fabrication in accordance with AASHTO M 111. Damage to the galvanizing shall be repaired with one coat of Formula A-9-73 paint conforming to Section 9-08.2.

The embed loops and connector bars shall be fabricated of steel wire conforming to AASHTO M 32, and shall be galvanized after fabrication in accordance with AASHTO M 111.

Filter fabric joint cover for all horizontal and inclined joints shall be a monofilament filter fabric as recommended by Foster Geotechnical. Adhesive used to attach the fabric to the rear of the precast concrete facing panel shall be as recommended by Foster Geotechnical.

Concrete Block Faced Structural Earth Wall Materials

General Materials

Concrete Block

Acceptability of the blocks will be determined based on the following:

1. Visual inspection.
2. Compressive strength tests, conforming to Section 6-13.3(4).
3. Water absorption tests, conforming to Section 6-13.3(4).
4. Manufacturer's Certificate of Compliance in accordance with Section 1-06.3.
5. Freeze-thaw tests conducted on the lot of blocks produced for use in this project, as specified in Section 6-13.3(4).
6. Copies of results from tests conducted on the lot of blocks produced for this project by the concrete block fabricator in accordance with the quality control program required by the structural earth wall manufacturer.

The blocks shall be considered acceptable regardless of curing age when compressive test results indicate that the compressive strength conforms to the 28-day requirements, and when all other acceptability requirements specified above are met.

Testing and inspection of dry cast concrete blocks shall conform to ASTM C 140, and shall include block fabrication plant approval by WSDOT prior to the start of block production for this project.

Mortar

Mortar shall conform to ASTM C 270, Type S, with an integral water repellent admixture as approved by WSDOT. The amount of admixture shall be as recommended by the admixture manufacturer. To ensure uniform color, texture, and quality, all mortar mix components shall be obtained from one manufacturer for each component, and from one source and producer for each aggregate.

Drainage Geosynthetic Fabric

Drainage geosynthetic fabric shall be a non-woven geosynthetic conforming to the requirements in Section 9-33.1, for Construction Geotextile for Underground Drainage, Moderate Survivability, Class B.

Backfill for Concrete Block Faced Structural Earth Wall

All backfill material within the structural earth wall reinforced zone shall be free draining, free from organic or otherwise deleterious material.

Backfill material within the reinforced zone shall conform to Section 9-03.14(1), except that the maximum particle size for walls with geogrid reinforcement shall not exceed 1-1/4 inches.

All material within the structural earth wall reinforced zone shall be substantially free of shale or other soft, poor durability particles, and shall not contain recycled materials, such as glass, shredded tires, portland cement concrete rubble, or asphaltic concrete rubble. The material shall meet the following aggregate durability requirements:

Property	Test Method	Allowable Test Value
Los Angeles Wear,	AASHTO T 96	35 percent max.
500 rev.		
Degradation	WSDOT Test Method 113	15 percent min.

For walls with metallic soil reinforcement, all material within the structural earth wall reinforced zone shall meet the following chemical requirements:

Property	Test Method	Allowable Test Value
Resistivity	AASHTO T 288	3,000 ohm-cm, min.
pH	AASHTO T 289	5 to 10
Chlorides	AASHTO T 291	100 ppm max.
Sulfates	AASHTO T 290	200 ppm max.

If the resistivity of the backfill material equals or exceeds 5,000 ohm-cm, the specified chloride and sulfate limits may be waived.

For walls with geogrid soil reinforcement, all material within the structural earth wall reinforced zone shall meet the following chemical requirements:

Property	Test Method	Allowable Test Value
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Wall backfill material satisfying these gradation, durability, and chemical requirements shall be classified as nonaggressive.

Proprietary Materials

KeySystem I Wall

Reinforcing strips shall be composed of welded wire fabric strips conforming to AASHTO M 55 with wire conforming to AASHTO M 32, and attached to block connector plates conforming to ASTM A 36. Reinforcing strips and block connector plates shall be galvanized after fabrication in accordance with AASHTO M 111. Damage to galvanizing shall be repaired with one coat of Formula A-9-73 paint conforming to Section 9-08.2.

Block alignment pins shall be fiberglass conforming to the requirements of Keystone Retaining Wall Systems, Inc.

Block connector pins shall conform to AASHTO M 32, and shall be galvanized after fabrication in accordance with AASHTO M 111.

Mesa Wall

Geogrid reinforcement shall conform to Section 9-33.1 and shall be the following products conforming to the specified material properties:

Geogrid	Wide Width	^{1,2} Long Term
Product Name	Tensile Strength	Tensile Strength, T _{al}
Tensar UXMESA3	4,390 lb./ft. min.	1,220 lb./ft.
Tensar UXMESA4	6,920 lb./ft. min.	1,980 lb./ft.
Tensar UXMESA5	8,910 lb./ft. min.	2,640 lb./ft.
Tensar USMESA6	10, 760 lb./ft. min.	3,260 lb./ft.

¹These long term tensile strength requirements apply only in the geogrid direction perpendicular to the wall face.

²T_{al} shall be determined in accordance with WSDOT Standard Practice T 925, “Determination of Long-Term Strength for Geosynthetic Reinforcement”.

The wide width tensile strength of the geogrid shall be a minimum average roll value (the average test results for any sampled roll in a lot shall meet or exceed the values shown in the table). The strength shall be determined in accordance with ASTM D 6637, for multi-rib specimens.

The ultraviolet (UV) radiation stability, ASTM D 4355, shall be a minimum of 70 percent strength retained after 400 hours in the weatherometer.

The longitudinal (i.e., in the direction of loading) and transverse (i.e., parallel to the wall or slope face) ribs that make up the geogrid shall be perpendicular to one another. The maximum deviation of the cross-rib from being perpendicular to the longitudinal rib (skew) shall be no more

than 1 inch in 5 feet of geogrid width. The maximum deviation of the cross-rib at any point from a line perpendicular to the longitudinal ribs located at the cross-rib (bow) shall be 0.5 inches.

The gap between the connector and the bearing surface of the connector tab cross-rib shall not exceed 0.5 inches. A maximum of 10% of connector tabs may have a gap between 0.3 inches and 0.5 inches. Gaps in the remaining connector tabs shall not exceed 0.3 inches.

The geogrid shall not exhibit brittle fracture (snapping, or rapid crack development), when tested in accordance with Test Method WSDOT T 926.

WSDOT will take random samples of the geogrid materials at the job site. Approval of the geogrid materials will be based on testing of samples from each lot. A “lot” shall be defined as all geogrid rolls sent to the project site produced by the same manufacturer during a continuous period of production at the same manufacturing plant having the same product name. The Contracting Agency will require 14 calendar days maximum for testing the samples after their arrival at the WSDOT Materials Laboratory in Tumwater, WA.

The geogrid samples will be tested for conformance to the specified material properties. If the test results indicate that the geogrid lot does not meet the specified properties, the roll or rolls which were samples will be rejected. Two additional rolls for each roll tested which failed from the lot previously tested will then be selected at random by WSDOT for sampling and retesting. If the retesting shows that any of the additional rolls tested do not meet the specified properties, the entire lot will be rejected. If the test results from all the rolls retested meet the specified properties, the entire lot minus the roll(s) which failed will be accepted.

All geogrid materials which have defects, deterioration, or damage, as determined by WSDOT, will be rejected. All rejected geogrid materials shall be replaced at no expense to the Contracting Agency.

Except as otherwise noted, geogrid identification, storage and handling shall conform to the requirements specified in Section 2-12.2. The geogrid materials shall not be exposed to temperatures less than –20F and greater than 122F.

Block connectors shall be glass fiber reinforced high-density polyethylene (HDPE) conforming to the following minimum material specifications:

Property	Specification	Value
Fiberglass Content	ASTM D 578, Grade E	30 percent
Tensile Strength	ASTM D 638	
at yield		7,250 psi
Tensile Elongation	ASTM D 638	

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

at break		7 percent
Tensile Modulus	ASTM D 638	479,000 psi
Flexural Modulus	ASTM D 790	522,000 psi
Flexural Strength	ASTM D 790	9,430 psi
Izod Impact	ASTM D 256	
notched 1/8 inch		162 ft.-lb./inch
Melt Flow Rate	ASTM D 1238	0.07 ounces/10 min.
Heat Deflection Temp.	ASTM D 648	
at 66 psi		260F
at 264 psi		220F
Ash Content	ASTM D 2584	27 to 33 percent
Specific Gravity	ASTM D 792	1.20
Mold Shrinkage	ASTM D 955	0.05 inch/inch
Rockwell Hardness	ASTM D 785	80

Construction Requirements

Section 6-13.3 is supplemented with the following:

Welded Wire Faced Structural Earth Wall

Welded wire faced structural earth walls shall be constructed only with the Hilfiker Welded Wire Retaining Wall (WW) system. Hilfiker is a registered trademark of Hilfiker Retaining Walls.

The Design-Builder shall make arrangements to purchase the welded wire mats, backing mats, facing elements, fasteners, construction geotextile for wall facing, and all necessary incidentals from the following source:

Hilfiker Retaining Walls

P. O. Box 2012

Eureka, CA 95501-2012

(707) 443-5093

FAX (707) 443-2891

Precast Concrete Panel Faced Structural Earth Wall

Precast concrete panel faced structural earth walls shall be constructed of only one of the following wall systems. The Design-Builder shall make arrangements to purchase the precast concrete panels, soil reinforcement, attachment devices, joint filler, and all necessary incidentals from the source identified with each wall system:

ARES Modular Panel Wall System

ARES Modular Panel Wall System is a registered trademark of Tensar Earth Technologies, Inc.

Tensar Earth Technologies, Inc.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
5883 Glenridge Drive Suite 200
Atlanta, GA 30328
(800) 836-7271

MSE Plus Wall

MSE Plus is a registered trademark of SSL, LLC.

SSL, LLC
4740-E Scotts Valley Drive
Scotts Valley, CA 95066
(831) 430-9300
FAX (831) 430-9340

Reinforced Earth Wall

Reinforced Earth is a registered trademark of the Reinforced Earth Company.

The Reinforced Earth Company
20381 Lake Forest Drive Suite B-2
Lake Forest CA, 92630
(949) 587-3060

Reinforced Soil Wall

Reinforced Soil is a registered trademark of Hilfiker Retaining Walls.

Hilfiker Retaining Walls
P. O. Box 2012
Eureka, CA 95501-2012
(707) 443-5093
FAX (707) 443-2891

Retained Earth Wall

Retained Earth is a registered trademark of Foster Geotechnical.

Foster Geotechnical
1660 Hotel Circle North Suite 304
San Diego, CA 92108
(619) 688-2400
FAX (619) 688-2499

Concrete Block Faced Structural Earth Wall

Concrete block faced structural earth walls shall be constructed of only one of the following wall systems. The Design-Builder shall make arrangements to purchase the concrete blocks, soil reinforcement, attachment devices, joint filler, and all necessary incidentals from the source identified with each wall system:

Mesa Wall

Mesa Wall is a registered trademark of Tensar Earth Technologies, Inc.

Tensar Earth Technologies, Inc.

5883 Glenridge Drive Suite 200

Atlanta, GA 30328

(800) 836-7271

KeySystem I Wall

KeySystem I is a registered trademark of Keystone Retaining Wall Systems, Inc.

Keystone Retaining Wall Systems, Inc.

2061 NW Alcock Drive Suite 907

Hillsboro, OR 97214

(800) 733-7470

(FAX (503) 439-8592

Precast Concrete Facing Panel and Concrete Block Fabrication

Section 6-13.3(4) is supplemented with the following:

Specific Fabrication Requirements for Proprietary Precast Concrete Panel Faced Structural Earth Walls

ARES Modular Panel Wall System

The concrete mix for precast concrete facing panels shall be a Design-Builder mix design in accordance with Section 6-02.3(2)A, producing a minimum compressive strength at 28 days of 4,500 psi. The Design-Builder mix design for precast concrete facing panels shall not include Type III cement unless otherwise approved by WSDOT.

The slot opening for geogrid attachment in precast concrete facing panels shall be 1/8 inch minimum. The Design-Builder shall test the slot opening of each concrete panel using a feeler gauge furnished by Tensar Earth Technologies, Inc. Concrete panels with slot dimension deviations that allow the feeler gauge to be pulled out of the slot shall be rejected.

MSE Plus Wall

The concrete mix for precast concrete facing panels using soil reinforcement mesh of either 6w20 or 6w24 shall be a Design-Builder mix design in accordance with Section 6-02.3(2)A, producing a minimum compressive strength at 28 days of 5,000 psi. The Design-Builder mix design for all precast concrete facing panels shall include Type II cement only.

Rods forming the internal connection channel in precast concrete facing panels shall be turned within 20 minutes of concrete placement in each concrete panel, and removed between 3 and 24 hours after concrete placement.

Precast Concrete Facing Panel and Concrete Block Erection

Section 6-13.3(5) is supplemented with the following:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
**Specific Erection Requirements for Proprietary Precast Concrete Panel
Faced Structural Earth Walls**

MSE Plus Wall

The loop pockets and access pockets of the internal connection channel of the precast concrete facing panels shall be cleaned of all backfill and extraneous materials prior to inserting the pins to connect the soil reinforcing mesh to each concrete panel.

**Specific Erection Requirements for Proprietary Concrete Block Faced
Structural Earth Walls**

Mesa Wall

For all concrete block courses receiving geogrid reinforcement, the fingers of the block connectors shall engage the geogrid reinforcement apertures, both in the connector slot in the block, and across the block core. For all concrete block courses with intermittent geogrid coverage, a #3 steel reinforcing bar shall be placed, butt end to butt end, in the top block groove, with the butt ends being placed at a center of a concrete block.

Backfill

Section 6-13.3(7) is supplemented with the following:

**Specific Backfill Requirements for Proprietary Precast Concrete Panel
Faced Structural Earth Walls**

MSE Plus Wall

At each wall reinforcement level, the Design-Builder shall place the backfill to the level of the connection. Backfill placement and compaction methods shall ensure that no voids exist directly beneath the wall reinforcement near the precast concrete facing panels.

6-15, SOIL NAIL WALLS

Materials

Section 6-15.2 is supplemented with the following:

Permanent Soil Nail Materials and Components

A soil nail system is a structural system used to transfer tensile loads to soil. A soil nail system may also be specified in the Plans as a nail. A soil nail system includes all steel reinforcing bars, anchorage devices, grout, coatings, sheathings and couplers if used.

The Design-Builder shall either select a soil nail system from the Qualified Products List, or submit the following information to WSDOT for approval:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

1. Catalogue cuts or Manufacturer's Certificates of Compliance for centralizers and grout admixtures.
2. Manufacturer's Certificate of Compliance for bearing plates, nuts, steel reinforcing bars, tendon encapsulation tubing, and welded shear studs. The Manufacturer's Certificate of Compliance for the nuts shall confirm compliance with the specified strength requirements.

If the Design-Builder selects a permanent soil nail system from the Qualified Products List (QPL), the Design-Builder shall submit, to WSDOT, a certificate from the permanent soil nail system fabricator/supplier confirming that the material specifications of the permanent soil nail system components as furnished conform to those specified in the QPL submittal as approved by WSDOT.

Component Material Specifications

Bearing plates shall conform to ASTM A 36, ASTM A 529, ASTM A 536, ASTM A 572, ASTM A 588, or AASHTO M 270.

Centralizers shall be fabricated from plastic, steel, or material which is nondetrimental to the prestressing steel. Wood shall not be used.

Grout shall be a neat cement grout or a sand-cement grout. The compressive strength for the grout shall be as required by the soil nail manufacturer and as approved by WSDOT. Grout components shall be as follows:

Admixtures shall conform to the requirements of Section 9-23.6. Expansive admixtures and accelerators will not be permitted. Admixtures shall be mixed in accordance with the manufacturer's recommendations.

Aggregates shall conform to the requirements of Section 9-03.

Cement shall conform to the requirements of Section 9-01, and shall not contain lumps or other indications of hydration.

Nuts shall conform to either AASHTO M 291, Grade B, Hexagonal, ASTM A 536 Grade 100-70-03, ASTM A 29 Grades 12L14, 1215, or C1045, AASHTO M 169 Grades 1117 or 12L14, ASTM A 513 Type 5 Grade 1026, ASTM A 521 Class CF, ASTM A 897 Grade 125/80/10M, or ASTM A 519 Grade 1026, and shall be capable of developing 100 percent of the GUTS of the soil nail. The nuts shall be fitted, where necessary, with a special wedge washer or spherical seat such that the nut bears uniformly on the bearing plate.

Washers shall conform to either AASHTO M 293, ASTM A 536 Grade 80-55-06 or ASTM A 47 Grade 32510.

Soil nails shall be deformed steel reinforcing bars conforming to AASHTO M 31, Grade 60 minimum, and Section 9-07.2. All soil nails, except those specified in the Plans to be encapsulated, shall be epoxy-coated in accordance with Sections 6-02.3(24)H and 9-07.3. The soil nails shall be of the type and size specified in the Plans. The soil nails shall not be spliced. The soil nails shall be threaded at the bearing plate end a minimum of six inches. The threading shall be continuous spiral deformed ribbing. Alternatively, threads may be cut into the soil nail if the bar size is increased to the next larger size from the size specified in the Plans at no additional cost to the Contracting Agency.

Tendon encapsulation, when specified in the Plans to provide additional corrosion protection, shall be fabricated from one of the following:

1. High density corrugated polyethylene (PE) tubing conforming to the requirements of ASTM D 3350 Class PE335520C or Class PE335400C, ASTM D 1248, and AASHTO M 252 and having a nominal wall thickness of 40 mils.
2. Corrugated, polyvinyl chloride (PVC) tubing conforming to ASTM D 1784, Class 13464-B, and having a nominal wall thickness of 40 mils.

The soil nails shall be centralized within the sheathing with a minimum 0.2 inch grout cover over the soil nail inside the sheath. The encapsulation shall be constructed at the factory under controlled conditions. Field construction of the encapsulation will not be permitted.

Welded shear studs shall conform to Section 9-06.15, and shall be welded in accordance with Section 6-03.3(25).

6-17, PERMANENT GROUND ANCHORS

Materials

Section 6-17.2 is supplemented with the following:

Permanent Ground Anchor Materials and Components

A permanent ground anchor system is a structural system used to transfer tensile loads to soil or rock. A permanent ground anchor system may also be specified in the Plans as an anchor, a ground anchor, or a tieback. A permanent ground anchor system includes all prestressing steel, anchorage devices, grout, coatings, sheathings and couplers if used.

The Contractor shall either select a permanent ground anchor system from the Qualified Products List or submit the following information to the Engineer for approval:

1. Catalogue cuts or Manufacturer's Certificates of Compliance for anchorage covers, bond breaker, centralizers, corrosion inhibiting grease, end caps, grout admixtures, and strand tendon spacers.
2. Manufacturer's Certificates of Compliance for anchor heads, anchor head wedges, bar tendon nuts, bar tendon couplers, tendon encapsulation tubing, trumpet assemblies, and bar tendons or strand tendons. The Manufacturer's Certificates of Compliance for the anchorhead wedges (grippers), and bar tendon nuts and couplers, shall confirm compliance with the specified strength requirements.

If the Contractor selects a permanent ground anchor system from the Qualified Products List (QPL), the Contractor shall submit, to the Engineer, a certificate from the permanent ground anchor system fabricator/supplier confirming that the material specifications of the permanent ground anchor system components as furnished conform to those specified in the QPL submittal as approved by WSDOT.

Component Material Specifications

Anchorage covers shall have a minimum thickness of 0.20 inches and shall conform to either ASTM A 53 for pipe, or ASTM A 500 for tubing, or ASTM A

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
36, ASTM A 529, ASTM A 572, ASTM A 588, or AASHTO M 270 for fabricated steel.

Anchorheads shall conform to either ASTM A 36, AASHTO M 169 Grades 1040 or 1045, ASTM A 521 Grade 1045, ASTM A 576 Grade 1045, or ASTM A 536 Grade 80-55-06.

Bearing plates shall conform to either ASTM A 36, ASTM A 572, ASTM A 588, AASHTO M 270, ASTM A 529, or ASTM A 536.

Anchorhead wedges (grippers) shall conform to AASHTO M 169 Grade 12L14, case hardened 0.012 to 0.015 inches deep to Rockwell C 59 to 65.

Bar tendon nuts shall conform to either ASTM A 29 Grade C1045, ASTM A 521 Class CF, AASHTO M 169 Grades 1117 or 1144, or ASTM A 536 Grade 100-70-03, and shall be capable of developing 100 percent of the GUTS of the bar tendon.

Bondbreaker shall conform to the requirements of Section 4.8 of the Post-Tensioning Institute "Recommendations for Prestressed Rock and Soil Anchors", Third Edition - 1996, and shall be fabricated from a smooth plastic tube or pipe having the following properties:

1. Resistant to chemical attack from aggressive environments, grout or grease;
2. Resistant to aging by ultra-violet light;
3. Fabricated from material nondetrimental to the tendon;
4. Capable of withstanding abrasion, impact, and bending during handling and installation;
5. Enable the tendon to elongate during testing and stressing; and
6. Allow the tendon to remain unbonded after lock-off.

Centralizers shall be fabricated from plastic, steel, or material which is nondetrimental to the prestressing steel. Wood shall not be used.

Corrosion inhibiting grease shall conform to the requirements of Section 3.2.5 of the Post-Tensioning Institute, "Specification For Unbonded Single Strand Tendons".

Couplers for bar tendons, if required, shall be furnished by the manufacturer of the bar tendons and shall be AASHTO M 169 Grades 1045, 1117 or 1144, ASTM A 519 Grade 1026, or equivalent steel developing 100 percent of the GUTS of the bar tendon without evidence of any failure. Couplers shall be placed in the bond zone. Couplers for strand tendons will not be allowed.

End caps shall conform to ASTM D 3350 Class PE324420C or Class PE335400C, ASTM D 1248, and AASHTO M 252, ASTM D 1784 Class 1346B or ASTM A 36.

Grout shall be a neat cement grout or a sand-cement grout. The compressive strength for the grout shall be as required by the tieback manufacturer and as approved by the Engineer. Grout components shall be as follows:

Admixtures shall conform to the requirements of Section 9-23.6. Expansive admixtures shall only be added to the grout used for filling sealed

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
encapsulations, trumpets and anchorage covers. Accelerators will not be permitted. Admixtures shall be compatible with prestressing steels and mixed in accordance with the manufacturer's recommendations.

Aggregates shall conform to the requirements of Section 9-03.

Cement shall conform to the requirements of Section 9-01, and shall not contain lumps or other indications of hydration.

Prestressing steel shall consist of either bar tendons with an ultimate tensile strength of 150 ksi conforming to AASHTO M 275 Type II, or strand tendons with an ultimate tensile strength of 270 ksi conforming to AASHTO M 203. The Contractor shall submit certified mill test results and typical stress-strain curves along with samples from each heat, properly marked, for the prestressing steel to the Engineer. The typical stress-strain curve shall be obtained by approved standard practices. The guaranteed ultimate strength, yield strength, elongation, and composition shall be specified.

Strand tendon spacers shall be fabricated from plastic, steel, or material which is nondetrimental to the prestressing steel. Wood shall not be used.

Tendon encapsulation, when specified in the Plans to provide additional corrosion protection, shall be fabricated from one of the following:

1. High density corrugated polyethylene (PE) tubing conforming to the requirements of ASTM D 3350 Class PE335520C or Class 335400C, ASTM D 1248, and AASHTO M 252 and having a nominal wall thickness of 40 mils.
2. Corrugated, polyvinyl chloride (PVC) tubing conforming to ASTM D 1784, Class 13464-B, and having a nominal wall thickness of 40 mils.

Trumpet providing the transition from the bearing plate to the unbonded length corrosion protection shall be fabricated from a steel pipe or tube conforming to the requirements of ASTM A 53 for pipe or ASTM A 500 for tubing. The trumpet shall have a minimum wall thickness of 0.20 inches, and shall be seal welded to the bearing plate. The seal weld shall be visually inspected only, in accordance with Section 6-03.3(25)A.

6-18, SHOTCRETE FACING

Materials

Section 6-18.2 is supplemented with the following:

Shotcrete Facing

Portland cement shall be Type II in accordance with Section 9-01.2(1).

Air entrainment shall be 6.0 percent, \pm 1.5 percent.

Water for mixing and curing shall be clean and free from substances which may be injurious to concrete or steel, and shall be free of elements which would cause staining.

Aggregate for shotcrete shall meet the following gradation requirements:

Sieve Size	Percent Passing by Weight
------------	---------------------------

1/2 inch	100		
3/8 inch	90	to	100
U.S. No. 4	70	to	85
U.S. No. 8	50	to	70
U.S. No. 16	35	to	55
U.S. No. 30	20	to	35
U.S. No. 50	8	to	20
U.S. No. 100	2	to	10
U.S. No. 200	0	to	2.5

Coloration for Shotcrete Facing Finishing Alternative C

If shotcrete facing finishing Alternative C is specified, the Contractor shall provide shotcrete coloration for finishing the sculptured shotcrete to match the color of the natural surroundings. Approval of the final appearance of the coloration will be based on the pre-production test panel. Approval of the long-term properties of the coloration material shall be based on a manufacturer's certification which verifies the following to be true about the product:

1. Resistance to alkalis in accordance with ASTM D 543.
2. Demonstrates no change in coloration after 1,000 hours of testing in accordance with ASTM D 822.
3. Does not oxidize when tested in accordance with ASTM D 822.
4. Demonstrates resistance to gasoline and mineral spirits when tested in accordance with ASTM D 543.

Additionally, the certification shall provide the product name, proposed mix design and application method, and evidence of at least one project where the product, using the proposed mix and application method, was applied and which has provided at least five years or more of acceptable durability and color permanency.

**DIVISION 7 - DRAINAGE STRUCTURES, STORM SEWERS,
SANITARY SEWERS, WATER MAINS, AND CONDUITS**

7-05, MANHOLES, INLETS, CATCH BASINS, AND DRYWELLS

Construction Requirements

The third paragraph of Section 7-05.3 is supplemented with the following:

Where called for, catch basins shall be furnished with locking solid metal covers as detailed in Standard Plan B-2.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
DIVISION 8 - MISCELLANEOUS CONSTRUCTION

8-01, EROSION CONTROL AND WATER POLLUTION CONTROL

Construction Requirements

General

Section 8-01.3(1) is supplemented with the following:

Offsite Stormwater

Stormwater is known to enter the project site at the following locations:

*** \$\$1\$\$ ***

The Design-Builder shall, prior to disruption of the normal water course, intercept the offsite stormwater and pipe it either through or around the project site in such a manner that it is not combined with onsite stormwater and it is discharged at its pre-construction outfall point in such a manner that there is no increase in erosion below the site.

The method for performing this work shall be included in the Design-Builder's temporary erosion control plan.

Side Slope Treatment

Slopes shall be compacted within *** \$\$1\$\$ *** days of exposure of a new section of cut and construction of a new portion of an embankment.

8-02, ROADSIDE RESTORATION

Construction Requirements

Planting Area Preparation

Section 8-02.3(5) is supplemented with the following:

After the initial planting area weed control, soil placement, grading, and the installation of irrigation lines are completed, and prior to planting, all designated planting areas shall be covered with compost.

Prior to placement of compost, the application methods shall be approved by WSDOT.

Compost shall not be placed when a condition exists, such as frozen or water saturated soil, that may be detrimental to successful application or soil structure.

The Design-Builder shall notify WSDOT a minimum of five working days prior to the start of compost work.

Compost shall be uniformly and evenly placed in all designated areas at the rate of *** \$\$1\$\$ *** cubic yards per acre.

8-10, GUIDE POSTS

Description

Section 8-10.1 is supplemented with the following:

This work shall consist of furnishing and installing barrier delineators on concrete barrier when barrier runs concurrent with guide post locations.

Materials

Section 8-10.2 is supplemented with the following:

Barrier delineators shall consist of a flat plastic reflector lens or reflective sheeting attached to a housing or bracket to facilitate the mounting of the delineator on concrete traffic barrier. The reflective surface shall be rectangular or trapezoidal shape with a minimum area of 9 square inches for reflectors and 12 square inches for reflective sheeting. The housing or bracket can be flexible or rigid, molded from a durable plastic or other durable material approved by WSDOT. Barrier delineators shall be one sided for single direction or two sided for bi-directional.

Reflectors shall be acrylic or polycarbonate and shall conform to AASHTO M 290. Reflectors shall equal or exceed the following minimum values of specific intensity:

Observation Angle (Degrees)	Entrance Angle (Degrees)	Specific Intensity cd/ft-c	
		White	Yellow
0.1	0	126	75
0.1	20	50	30

Reflective sheeting for barrier delineators shall be type III, IV, V or VII and selected from approved materials listed in the Qualified Products List.

Construction Requirements

Section 8-10.3 is supplemented with the following:

Barrier delineators shall be placed on the traffic face of the barrier six inches down from the top. Spacing shall be as shown in the plans. Delineator color shall be white on the right of traffic and yellow on the left of traffic. The surface of the barrier where the delineator is applied shall be free of dirt, curing compound, moisture, paint, or any other material that would adversely affect the bond of the adhesive. Install delineators with an adhesive recommended by the manufacturer.

8-11, GUARDRAIL

Construction Requirements

Section 8-11.3 is supplemented with the following:

Box Culvert Guardrail Steel Post

The Contractor shall remove surfacing materials from the top of the box culvert and shall determine the length of the posts and 7/8 inch diameter high strength bolts. The Engineer will verify the dimensions before the posts may be fabricated.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

All surfacing material must be removed from the box culverts in an area extensive enough to allow installation of the baseplate. Before the grout is poured the concrete surface shall be thoroughly cleaned of all dirt, oil and debris.

The posts shall be installed to the box culvert in accordance with Standard Plan C-10.

After the posts are installed on the box culverts, the excavated areas shall be backfilled and compacted in 6-inch lifts. Compaction shall be accomplished with three passes with a mechanical tamper.

8-12, CHAIN LINK FENCE AND WIRE FENCE

Materials

Section 8-12.2 is supplemented with the following:

Coated Chain Link Fence

Chain link fence fabric shall be hot-dip galvanized with a minimum of 0.8 ounce per square foot of surface area.

Fencing materials shall be coated with an ultraviolet-insensitive plastic or other inert material at least 2 mils in thickness. Any pretreatment or coating shall be applied in accordance with the manufacturer's written instructions. The Design-Builder shall provide WSDOT with the manufacturer's written specifications detailing the product and method of fabrication. The color shall match Federal Standard number 595b-No. 2004 (dark brown), or be as approved by WSDOT.

Samples of the coated fencing materials shall be approved by WSDOT prior to installation on the project.

The Design-Builder shall supply WSDOT with 10 aerosol spray cans containing a minimum of 14 ounces each of paint of the color specified above. The touch-up paint shall be compatible with the coating system used.

8-13, MONUMENT CASES

Description

Section 8-13.1 is deleted and replaced by the following:

This work shall consist of furnishing and placing monument cases, covers, and pipes in accordance with the Standard Plans and these Specifications, in conformity with the lines and locations shown in the Plans or as staked by WSDOT.

This work shall include adjusting monument case and covers in accordance with the Standard Plans and these Specifications, in conformity with the lines and locations shown in the Plans.

Materials

Section 8-13.2 is supplemented with the following:

The pipe shall be Schedule 40 galvanized pipe.

Construction Requirements

The last paragraph of Section 8-13.3 is revised to read:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
WSDOT will be responsible for placing the concrete core and tack or wire inside the pipe.

Section 8-13.3 is supplemented with the following:

Adjusting Monument Cases

The monument case and cover shall be adjusted either by removing and resetting the case, or by installing riser rings between the case and cover.

Prior to planing operations, if any, the Contractor shall vertically adjust the monument case and cover below the limits for planing bituminous pavement. After paving operations are complete, the Contractor shall vertically adjust the monument case and cover to finish grade as shown in Standard Plan H-7. The Contractor shall be responsible for referencing the location of the monument case and cover for locating after paving is complete. The adjusted elevation of the cover shall be 1/4 inch to 1/2 inch below the level of the finished pavement. The case and cover shall be cleaned prior to being reset in accordance with Standard Plan H-7.

The Contractor shall use care to avoid disturbing the monument inside the monument case. Any damage or disturbance to the monument as a result of the Contractor's operations shall be repaired and reset to its original position at no cost to WSDOT

8-20, ILLUMINATION, TRAFFIC SIGNAL SYSTEMS, AND ELECTRICAL

Materials

Section 8-20.2 is supplemented with the following:

Light And Signal Standards

Light Standards with Type 1 Luminaire Arms

Lighting standards shall be fabricated in conformance with the methods and materials specified on the pre-approved plans listed below, provided the following requirements have been satisfied:

- (a) Mounting heights shall be as specified in the Plans.
- (b) Light source to pole base distances (H1) shall be determined or verified by WSDOT prior to fabrication. Fabrication tolerance shall be ± 6 inches.
- (c) All other requirements of the Special Provisions have been satisfied.

<u>Pre-Approved Plan</u>	<u>Fabricator</u>	<u>Mounting Hgt.</u>
Drawing No. DB00654 Rev. A Sheets 1, 2 & 3	Valmont Ind. Inc.	30', 40' & 50'
Drawing No. W3721-1 Rev. A & W3721-2	Ameron Pole Prod. Div.	40' & 50'
Drawing No. NWS 3510 Rev.	Northwest Signal	25', 30', 35',

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
 4-6-04 or NWS 3510B Rev. Supply Inc. 40', 45' & 50'
 4-6-04

Drawing WS-SL-01	American Pole	25', 30', 35',
	Structures, Inc.	40', 45', 50'
Drawing 71035-B39 Rev. 2	Union Metal	40'
Sheets 1 & 2	Corp.	
Drawing 71035-B38 Rev. 2	Union Metal	50'
Sheets 1 & 2	Corp.	
Drawing No. WSDOT-LP-01	West Coast	25', 30', 35', 40',
Rev. 0	Engineering	45', and 50'
Sheets 1 and 2	Group	

Traffic Signal Standards

Traffic signal standards shall be furnished and installed in accordance with the methods and materials noted in the applicable Standard Plans, pre-approved plans, or special design plans.

All welds shall comply with the latest AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. Welding inspection shall comply with Section 6-03.3(25)A Welding Inspection.

Hardened washers shall be used with all signal arm connecting bolts instead of lockwashers. All signal arm AASHTO M 164 connecting bolts shall be tightened to 40 percent of proof load.

Traffic signal standard types and applicable characteristics are as follows:

Type PPB Pedestrian push button posts shall conform to Standard Plan J-7a or to one of the following pre-approved plans:

<u>Fabricator</u>	<u>Drawing No.</u>
Northwest Signal	NWS 3530 or NWS 3530B
Supply Inc.	

Ameron Pole M3723 Rev. D
Prod. Div.

Union Metal Corp. TA-10035 Rev. 3

West Coast
Engineering Group WSDOT-PP-01 Rev. 0

Type PS Pedestrian signal standards shall conform to Standard Plan J-7a or to one of the following pre-approved plans:

<u>Fabricator</u>	<u>Drawing No.</u>
Northwest Signal Supply Inc.	NWS 3530 or NWS 3530B

Valmont Ind. Inc. DB00655 Rev. B

Ameron Pole M3723 Rev. D or W3539
Prod. Div.

Union Metal Corp. TA-10025 Rev. 13

West Coast
Engineering Group WSDOT-PP-02 Rev. 0

Type I Type I vehicle signal standards shall conform to Standard Plan J-7a or to one of the following pre-approved plans:

<u>Fabricator</u>	<u>Drawing No.</u>
Northwest Signal Supply Inc.	NWS 3530 or NWS 3530B

Valmont Ind. Inc. DB00655 Rev. B

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Ameron Pole

M3723 Rev. D or W3539

Prod. Div

Union Metal Corp.

TA-10025

Rev. 11

West Coast

Engineering Group

WSDOT-PP-02 Rev. 0

Type FB

Type FB flashing beacon standard shall conform to Standard Plan J-7a or the following pre-approved plan:

Fabricator

Union Metal Corp

Drawing No.

50200-B58 Rev. 3

Valmont Ind. Inc.

DB00655 Rev. B

Ameron Pole

W3539 Rev. B

Prod. Div.

Northwest Signal

NWS 3535 or NWS 3535B

Supply, Inc.

Type RM

Type RM ramp meter standard shall conform to Standard Plan J-7a or the following pre-approved plan:

Fabricator

Union Metal Corp

Drawing No.

50200-B58 Rev. 3

Valmont Ind. Inc.

DB00655 Rev. B

Ameron Pole

W3539

Prod. Div.

Northwest Signal

NWS 3535 or NWS 3535B

Supply, Inc.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Type II Characteristics:

Luminaire mounting height	N.A.
Luminaire arms	N.A.
Luminaire arm length	N.A.
Signal arms	One Only

Type II standards shall conform to one of the following pre-approved plans, provided all other requirements noted herein have been satisfied. Maximum (x) (y) (z) signal arm loadings in cubic feet are noted after fabricator.

Signal Arm

<u>Length (max)</u>	<u>Fabricator-(x) (y) (z)</u>	<u>Drawing No.</u>
65 ft.	Valmont Ind. Inc.-(2894)	DB00625-Rev. D, Shts. 1, 2 & 3
65 ft.	Union Metal Corp. (2900)	71026-B86 Rev. 4 shts. 1, 2, & 3
65 ft.	Ameron Pole-(2900) Prod. Div.	W3724-1 Rev. A & W3724-2 Rev. C
65 ft.	Northwest Signal-(2802) Supply Inc.	NWS 3500 Rev. 10/14/03 or NWS 3500B Rev. 10/14/03
45 ft.	American Pole(1875) Structures, Inc.	WS-T2-L Rev. 1
65 ft.	American Pole (2913) Structures, Inc.	WS-T2-H Rev. 1

Type III Characteristics:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Luminaire mounting height	30 ft., 35 ft., 40 ft., or 50 ft.
Luminaire arms	One Only
Luminaire arm type	Type 1
Luminaire arm length (max.)	16 ft.
Signal arms	One Only

Type III standards shall conform to one of the following pre-approved plans, provided all other requirements noted herein have been satisfied. Maximum (x) (y) (z) signal arm loadings in cubic feet are noted after fabricator.

Signal Arm

<u>Length (max)</u>	<u>Fabricator-(x) (y) (z)</u>	<u>Drawing No.</u>
65 ft.	Valmont Ind. Inc.-(2947)	DB00625-Rev. D, Shts. 1, 2 & 3 and "J" luminaire arm
65 ft.	Union Metal Corp. (2900)	71026-B87 Rev. 4 Shts. 1, 2 & 3
65 ft.	Ameron Pole-(2900) Prod. Div.	W3724-1 Rev. A & W3724-2 Rev. C and "J" luminaire arm
65 ft.	Northwest Signal-(2802) Supply Inc.	NWS 3500 Rev. 10/14/03 or NWS 3500B Rev. 10/14/03
45 ft.	American Pole (1875) Structures, Inc.	WS-T3J-L, Rev. 1, Shts. 1 & 2
65 ft.	American Pole (2913) Structures, Inc.	WS-T3J-H Rev. 1, Shts. 1 & 2

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Type IV Type IV strain pole standards shall be consistent with details in the plans and Standard Plan J-7c or one of the following pre-approved plans:

<u>Fabricator</u>	<u>Drawing No.</u>
Northwest Signal Supply Inc.	NWS 3520 or NWS 3520B,
Valmont Ind. Inc.	5000-4
Ameron Pole Prod. Div.	M3650 Rev. A
Union Metal Corp.	EA-10224 Rev. 8
American Pole Structures, Inc.	9000-12-037 Rev. A
West Coast Engineering Group	WSDOT-TS-01 Rev. 0 Sheets 1, 2, and 3

Type V Type V combination strain pole and lighting standards shall be consistent with details in the plans and Standard Plan J-7c or one of the following pre-approved plans:

<u>Fabricator</u>	<u>Drawing No.</u>
Northwest Signal Supply Inc.	NWS 3520 or NWS 3520B
Valmont Ind. Inc.	5000-4
Ameron Pole Prod. Div.	M3650 Rev. A
Union Metal Corp.	EA-10225, Rev. 8 Shts. 1 & 2

The luminaire arm shall be Type 1, 16 foot maximum and the luminaire mounting height shall be 40 feet or 50 feet as noted in the plans.

Type SD Type SD standards require special design. All special design shall be based on the latest AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and pre-approved plans and as follows:

1. A 90 mph wind loading shall be used.
2. The Design Life and Recurrence Interval shall be 50 years for luminaire support structures exceeding 50 feet in height, and 25 years for all other luminaire support structures.
3. Fatigue design shall conform to AASHTO Section 11, Table 11-1 using fatigue category III.

Complete calculations for structural design, including anchor bolt details, shall be prepared by a Professional Engineer, licensed under Title 18 RCW, State of Washington, in the branch of Civil or Structural Engineering or by an individual holding valid registration in another state as a civil or structural Engineer.

All shop drawings and the cover page of all calculation submittals shall carry the Professional Engineer's original signature, date of signature, original seal, registration number, and date of expiration. The cover page shall include the contract number, contract title, and sequential index to calculation page numbers. Two copies of the associated design calculations shall be submitted for approval along with shop drawings.

Details for handholes and luminaire arm connections are available from the Bridges and Structures Office.

Foundations for various types of standards shall be as follows:

- Type PPB As noted on Standard Plan J-7a.
Type PS As noted on Standard Plan J-7a.
Type I As noted on Standard Plan J-7a.
Type FB As noted on Standard Plan J-7a
Type RM As noted on Standard Plan J-7a
Type II As noted in the Plans.
Type III As noted in the Plans.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
Type IV As noted in the Plans and Standard Plan J-7c.
Type V As noted in the Plans and Standard Plan J-7c.
Type SD As noted in the Plans.

Construction Requirements

Section 8-20.3 is supplemented with the following:

General

Section 8-20.3(1) is supplemented with the following:

Poles designated for removal shall not be removed prior to approval of the Engineer.

Remove all wires from salvaged light and signal standards.

Controller cabinets shall not be removed until all associated electronic equipment is removed by WSDOT signals personnel. All other equipment shall be removed by the Contractor and delivered within 24 hours following removal to the WSDOT.

Span wire shall not be lowered or disconnected from strain poles until all associated signal heads and signs have been removed from the span.

All removals associated with an electrical system, which are not designated to remain the property of the WSDOT, shall become the property of the Contractor and shall be removed from the project.

The Contractor shall:

Remove all wires for discontinued circuits from the conduit system.

Remove elbow sections of abandoned conduit entering junction boxes.

Abandoned conduit encountered during excavation shall be removed to the nearest outlets or as directed by the Engineer.

Remove foundations entirely, unless the Plans state otherwise.

Backfill voids created by removal of foundations and junction boxes. Backfilling and compaction shall be performed in accordance with Section 2-09.3(1)E.

Electrical System Removals

All removals associated with an electrical system, which are not designated to remain the property of the WSDOT, shall become the property of the Contractor and shall be removed from the project.

The Contractor shall:

Remove all wires for discontinued circuits from the conduit system.

Remove elbow sections of abandoned conduit entering junction boxes.

Abandoned conduit encountered during excavation shall be removed to the nearest outlets or as directed by the Engineer.

Remove foundations entirely, unless the Plans state otherwise.

Backfill voids created by removal of foundations and junction boxes. Backfilling and compaction shall be performed in accordance with Section 2-09.3(1)E.

Delivery of Removed Items

Removed electrical equipment which remains the property of the WSDOT shall be delivered to:

WSDOT Signal Shop

3700 9th Ave. So.

Seattle WA 98134

Phone: (206) 764-4014

Five days written advance notice shall be delivered to both the Engineer and the Electronic Parts Specialist at the address listed above. Delivery shall occur during the hours of 8:00 a.m. to 2:30 p.m. Monday thru Friday. Material will not be accepted without the required advance notice.

Equipment damaged during removal or delivery shall be repaired or replaced to the Engineer's satisfaction at no cost to the WSDOT.

The Contractor shall be responsible for unloading the equipment where directed by the Engineer at the delivery site.

Pole Shaft and Mast Arm Identification

All removed mast arms and pole shafts shall be identified by paper identification tags recording pole number, intersection location (such as SR XXX, Jct XXX), and mast arm length.

Four inch by six inch (minimum) tags shall be taped to corresponding pole shafts and mast arms. Information on the mast arm tag shall match the information on the corresponding pole shaft tag. Each tag shall be entirely covered with clear acetate tape. The tape shall be wrapped one full circle around the shaft or arm with a 1/2 inch minimum overlap at the ends and sides.

The Contractor shall bundle the complete signal standard assembly together. The assembly consists of pole shaft, mast arm, and connecting bolts. Connecting bolts shall be attached to the original mast arm base plate.

Surface Mounted Appurtenances

Electrical appurtenances to be surface mounted on structures shall be mounted so that a minimum 1/4 inch space is maintained between the appurtenance and structure.

Conduit Coatings

Section 8-20.3(5) is supplemented with the following:

Conduit fittings for steel conduit shall be coated with galvanizing repair paint in the same manner as conduit couplings. Electroplated fittings are not allowed.

Steel conduit entering concrete shall be wrapped in 2-inch-wide pipe wrap tape with a minimum 1-inch overlap for 12 inches on each side of the concrete face. Pipe wrap tape shall be installed per the manufacturer's recommendations.

Conduit

Section 8-20.3(5) is supplemented with the following:

Conduit installed at the following locations shall be Rigid Galvanized Steel:

Within railroad right of way unless otherwise specified in the contract.

All runs within slip form structures.

Conduit risers except as otherwise required by serving utilities.

Surface mounted conduit other than conduit risers.

Couplings in cabinet foundations shall be Rigid Galvanized Steel. The stubouts above the couplings shall be Rigid Galvanized Steel with grounding bushings.

Conduit installed using the directional boring method shall be UL listed High Density Polyethylene (HDPE) Schedule 80, Carlon Bore-Gard Schedule 80 or Rigid Galvanized Steel. Connections to HDPE conduit shall be made with an approved mechanical coupler.

At all other locations, unless otherwise specified in the Plans, conduit shall be PVC or Rigid Galvanized Steel.

Conduit shall be laid to a minimum depth of:

48 inches below the bottom of ties under rail road tracks.

24 inches below the curb grade in the sidewalk area.

24 inches below finished grade in all other areas.

Conduit stub-outs within cabinet foundations shall be placed so that they do not interfere with cabinet installation. Modification of the cabinet to accommodate stub-out placement is not allowed.

A pull string rated for 200 lbs. or greater shall be installed in all spare conduit.

All conduit including spare conduits shall be installed with bushings. Rigid Galvanized Steel conduit shall be installed with insulated grounding bushings. PVC conduit shall be installed with molded one-piece bell end bushings.

All conduits including spare conduits shall be installed with plugs, which shall not be removed until installation of conductors or pull string. Upon installation of wiring, conduit shall be sealed with duct seal. Upon installation of the pull string, spare conduit shall be plugged

Conduit between light standards, PPB, PS or type I poles and the nearest junction box shall be the diameter specified in the Plans. Larger size conduit is not allowed at these locations.

Spacing of unistrut type channel supports for surface mounted conduit shall not exceed 5 feet.

Where Rigid Galvanized Steel conduit is installed:

Insulated grounding end bushings shall have standard threading, which extends around the entire circumference of the bushing.

Where PVC conduit is installed:

Conduit shall be schedule 40, with the exception that roadway crossings, and service lateral runs shall be schedule 80. The same schedule and type of conduit shall be used for the entire length of the run from outlet to outlet and from HDPE conduit crossing the roadway to the nearest junction box.

Eighteen-inch radius elbows shall be used for conduit of 2-inch nominal diameter or less.

Standard sweep elbows shall be used for conduit with greater than 2-inch nominal diameter unless otherwise specified in the Plans.

With the exception of connections to HDPE conduit, joints shall be connected with medium grade gray cement solvent applied per the manufacturer's recommendations.

In conduit less than 2-inch nominal diameter, pull ropes for wire installation shall be not less than ¼ inch diameter. In conduit of 2 inch nominal diameter or larger, pull ropes for wire installation shall be not less than ½ inch diameter.

Trenches located within paved roadway areas shall be backfilled with 3 inches of sand over the conduit, followed by controlled density fill meeting the requirements of Section 2-09.3(1)E. Unless otherwise indicated in the Plans, the controlled density fill shall be placed level to, and 3 inches below, the surface of the remaining pavement, followed by 3 inches of paving material that matches the existing material.

On new construction, conduit shall be placed prior to the placement of base course pavement.

Conduit Coatings

Conduit fittings for steel conduit shall be coated with galvanizing repair paint in the same manner as conduit couplings. Electroplated fittings are not allowed.

Steel conduit entering concrete shall be wrapped in 2-inch-wide pipe wrap tape with a minimum 1-inch overlap for 12 inches on each side of the concrete face. Pipe wrap tape shall be installed per the manufacturer's recommendations.

Boring

Where boring with casing is called for casing shall be placed using an auger inside of the casing to remove the soil as the casing is jacked forward. Boring operations shall be conducted to prevent caving ahead of the pipe which will cause voids outside the pipe. The auger head shall proceed no more than 4 inches ahead of the pipe being jacked.

The Contractor shall submit to the Engineer for approval, a pit plan and a proposed method of boring that includes, but is not limited to, the following:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

- a. A pit plan depicting:
 1. Protection of traffic and pedestrians.
 2. The dimension of the pit.
 3. Shoring, bracing, struts, walers, or sheet pile
 4. Type of casing
- b. The proposed method of boring, including:
 1. The boring system
 2. The support system
 3. The support system under and at the bottom of the pit.

The shoring and boring pit plan shall be prepared by and bear the seal and signature of a Washington State licensed Professional Civil Engineer.

Installed casing pipe shall be free from grease, dirt, rust, moisture and any other deleterious contaminants.

All joints shall be welded by a Washington State certified welder. Welding shall conform to AWS D 1.1-80 Structural Welding Code, Section 3, Workmanship.

The space between the conduit and the casing shall be plugged with sand bags and shall be filled with a grout sealant at least 1 foot thick at each end of the casing. Casings abandoned due to encountered obstruction shall be grout sealed in the same manner. Grout shall obtain a minimum of 400 psi compressive strength at 7 days.

In lieu of sandbags and grout, unopened sacks of prepackaged concrete meeting the requirements of Section 6-02.3(2)B may be used to seal the casing.

Material shall not be removed from the boring pits by washing or sluicing.

Bore pits shall be backfilled and compacted in accordance with Section 2-09.3(1)E.

Directional Boring

Drilling fluid used for directional boring shall be an inert mixture of water and bentonite clay conforming to the drilling equipment manufacturer's recommendations.

Where directional boring is called for, conduit shall be installed using a surface launched steerable drilling tool. Drilling shall be accomplished using a high pressure fluid jet toolhead. The drilling fluid shall be used to maintain the stability of the tunnel, reduce drag on the conduit and provide backfill between the conduit and tunnel. A guidance system which measures the depth, lateral position and roll shall be used to guide the toolhead when creating the pilot hole. Once the pilot hole is established a reamer and swivel shall be used to install the conduit. Reaming diameter shall not exceed 1.5 times the diameter of the conduit being installed. Conduit which is being pulled into the tunnel shall be protected and supported so that it moves freely and is not damaged during installation. The pullback force on the conduit shall be controlled to prevent damage to the conduit. A vacuum spoils extraction system shall be used to

remove any excess spoils generated during the installation. Excess drilling fluid and spoils shall be disposed of. The method and location used for disposal of excess drilling fluid and spoils shall be subject to the Engineers approval. Drilling fluid returns (caused by fracturing of formations) at locations other than the entry and exit points shall be minimized. Any drilling fluid that surfaces through fracturing shall be cleaned up immediately. Mobile spoils removal equipment capable of quickly removing spoils from entry or exit pits and areas with returns caused by fracturing shall be used as necessary during drilling operations.

Liquidtight Flexible Metallic Conduit

Liquidtight flexible metallic conduit and associated couplings, connectors, and fittings shall conform to Article 350 of the National Electric Code.

Steel Casing

Casing pipe for conduit shall be steel and shall conform to ASTM A252 GR2 or 3. The diameter shall be as specified in the Plans. The wall thickness shall be adequate to withstand the forces to which it is subjected during installation. The minimum allowable wall thickness shall be 0.375 inches.

Surface Mounting Conduit Attachment Components

Unistrut type channel supports and fastening hardware components shall be stainless steel. Conduit clamps shall be hot-dip, galvanized steel or stainless steel, and shall be one piece, two bolt units with locking nuts. The clamps shall be attached to the unistrut type channel supports on both sides of the conduit with bolts and associated hardware. The minimum distance between adjacent clamps and between the clamp and the end of the unistrut type channel supports shall be one inch. Unistrut type channel supports shall be installed with stops which prevent clamps from sliding out of the ends.

Junction Boxes, Cable Vaults, and Pull Boxes

Section 8-20.3(6) is supplemented with the following:

Wiring shall not be pulled into any conduit until all associated junction boxes have been adjusted to or installed in their final grade and location, unless installation is necessary to maintain system operation. If wire is installed for this reason, sufficient slack shall be left to allow for future adjustment.

Prior to construction of finished grade, if junction boxes are installed or adjusted, premolded joint filler for expansion joints may be placed around the junction boxes. The joint filler shall be removed prior to adjustment to finished grade.

Adjustments involving raising or lowering the junction boxes shall require conduit modification if the resultant clearance between top of conduit and the junction box lid becomes less than 6-inches or more than 10-inches. Wiring shall be replaced if sufficient slack as specified in Section 8-20.3(8) is not maintained.

The 6-inch gravel pad required in Standard Plan J-11a shall be maintained. When existing junction boxes do not have this gravel pad, it shall be installed as part of the adjustment to finished grade.

Where conduit and junction boxes are placed in barrier, the prime Contractor shall coordinate the construction of the barrier and the electrical work so that each junction box placed in the barrier is placed in correct alignment with respect to the barrier, with the face of the box flush. The junction box shall be parallel to the top of the barrier within a 1-degree tolerance. If any point on the face of a junction box placed in barrier is recessed more than 1/8 inch from the surface of the barrier, the Contractor shall install a box extension per the Engineer's approval and grout around the extension or remove and replace the entire section of barrier.

All junction boxes placed within the traveled way or shoulders shall be type 4, 5 or 6.

Type 4, 5 and 6 junction boxes shall be installed in accordance with the following:

1. Excavation and backfill shall be in accordance with Section 2-09. Excavation for junction boxes shall be sufficient to leave 1 foot in the clear between their outer surface and the earth bank.
2. The junction box shall be installed on a level 6-inch layer of crushed surfacing top course, in accordance with 9-03.9(3), placed on a compacted or undisturbed foundation. The crushed surfacing shall be compacted in accordance with Section 2-09.3(1)E.
3. After installation, the lid shall be kept bolted down during periods when work is not actively in progress at the junction box.
4. Before closing the lid, the lid and the frame shall be thoroughly brushed and cleaned of all debris. There shall be absolutely no visible dirt, sand or other foreign matter between the bearing surfaces.
5. When the lid is closed for the final time, a liberal coating of anti-seize compound shall be applied to the bolts and nuts and the lid shall be securely tightened.
6. Hinges shall be located on the side of the box, which is nearest to the adjacent shoulder. Hinges shall allow the lid to open 180 degrees.

Wiring

Section 8-20.3(8) is supplemented with the following:

At each junction box, all illumination wires, power supply wires, and communication cable shall be labeled with a PVC marking sleeve. For illumination and power supply circuits the sleeve shall bear the circuit number. For communication cable the sleeve shall be marked "Comm."

Field Wiring Chart

501	AC+ Input	516-520	Railroad Pre-empt
502	AC- Input	5A1-5D5	Emergency Pre-empt
503-510	Control-Display	541-580	Coordination
511-515	Sign Lights	581-599	Spare

Movement Number	1	2	3	4	5	6	7	8	9
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Vehicle Head

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Red	611	621	631	641	651	661	671	681	691
Yellow	612	622	632	642	652	662	672	682	692
Green	613	623	633	643	653	663	673	683	693
Spare	614	624	634	644	654	664	674	684	694
Spare	615	625	635	645	655	665	675	685	695
AC-	616	626	636	646	656	666	676	686	696
Red Auxiliary	617	627	637	647	657	667	677	687	697
Yellow Auxiliary	618	628	638	648	658	668	678	688	698
Green Auxiliary	619	629	639	649	659	669	679	689	699
Pedestrian Heads & Dets.									
Hand	711	721	731	741	751	761	771	781	791
Man	712	722	732	742	752	762	772	782	792
AC-	713	723	733	743	753	763	773	783	793
Detection	714	724	734	744	754	764	774	784	794
Common-Detection	715	725	735	745	755	765	775	785	795
Spare	716	726	736	746	756	766	776	786	796
Spare	717	727	737	747	757	767	777	787	797
Spare	718	728	738	748	758	768	778	788	798
Spare	719	729	739	749	759	769	779	789	799
Detection									
AC+	811	821	831	841	851	861	871	881	891
AC-	812	822	832	842	852	862	872	882	892
Common-Detection	813	823	833	843	853	863	873	883	893
Detection A	814	824	834	844	854	864	874	884	894
Detection B	815	825	835	845	855	865	875	885	895
Loop 1 Out	816	826	836	846	856	866	876	886	896
Loop 1 In	817	827	837	847	857	867	877	887	897
Loop 2 Out	818	828	838	848	858	868	878	888	898
Loop 2 In	819	829	839	849	859	869	879	889	899
Supplemental Detection									
Loop 3 Out	911	921	931	941	951	961	971	981	991
Loop 3 In	912	922	932	942	952	962	972	982	992
Loop 4 Out	913	923	933	943	953	963	973	983	993
Loop 4 In	914	924	934	944	954	964	974	984	994
Loop 5 Out	915	925	935	945	955	965	975	985	995
Loop 5 In	916	926	936	946	956	966	976	986	996
Loop 6 Out	917	927	937	947	957	967	977	987	997
Loop 6 In	918	928	938	948	958	968	978	988	998
Spare	919	929	939	949	959	969	979	989	999

Bonding, Grounding

Section 8-20.3(9) is supplemented with the following:

All appurtenances containing electrical conductors (junction boxes, luminaires, light standards, cabinets, metallic conduit, non-metallic conduit, etc.) shall be made mechanically and electrically secure to form a continuous system, which shall be effectively grounded.

Where existing conduits are utilized, an equipment-grounding conductor shall be installed.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

In addition to the conductors called for in the contract, all conduit shall be installed with an equipment-grounding conductor sized per NEC 250-122, with the exception that the minimum size shall be 8 AWG.

Supplemental grounding shall be provided at light standards, signal standards, cantilever sign structures, and sign bridges. Steel sign posts which support signs with flashing beacons shall also have supplemental grounding. Foundations for these standards shall be installed with a bare, 6 AWG copper wire that is connected to the reinforcing cage with an approved acorn clamp or cadweld and routed to connect to the pole at the grounding lug.

Testing

Section 8-20.3(11) is supplemented with the following:

When the project includes a traffic signal, as part of the signal turn on procedure, the Contractor shall provide traffic control to stop all traffic from entering the intersection and shall then turn the traffic signal system to its flash mode to verify proper flash indications.

Prior to scheduling a turn-on date, the Contractor shall provide verification to the Engineer that:

- a. Field tests 1, 2, and 3 as specified in this section have been completed;
- b. All other field tests specified in Section 8-20.3(14)D have been completed.

Notification

The Contractor shall provide to the Engineer a minimum of five working days advance written notice of the proposed turn-on date and time.

Following turn-on, all conflicting signs shall be removed as directed by the Engineer.

Rebuilt Signal

Prior to scheduling a turn-on date, the Contractor shall install on each approach leg a "Signal Revision Ahead" sign on a 4 x 6 wood post at a location staked by the Engineer.

During the changeover, traffic control shall be provided by Contractor-hired off-duty uniformed police officers having jurisdiction in the area.

The changeover from the existing to the new control equipment shall commence at 8:30 a.m. and be completed by 2:00 p.m. of the same day. The Engineer may allow variations on these hours depending on field observations.

Illumination Systems

Light Standards

Section 8-20.3(13)A is supplemented with the following:

All new light standards shall have the service number and light standard number painted 3 feet above the base using 3-inch series C numbers installed facing the traveled way. Paint shall be black enamel alkylid gloss conforming to Federal Specification TT E-489.

When slip bases are installed the conduit, anchor bolts, and other obstructions shall terminate at a height below the elevation of the top of the bottom slip plate.

The galvanized surfaces of the slip plates, the keeper plate and the luminaire base plate shall be smooth, without irregularities, to reduce friction and to prevent slacking of bolt tension due to flattening of the irregularities.

Signal Controllers

Section 8-20.3(14)A is supplemented with the following:

Signal Heads

Section 8-20.3(14)B is supplemented with the following:

Unless ordered by the Engineer, signal heads shall not be installed at any intersection until all other signal equipment is installed and the controller is in place, inspected, and ready for operation at that intersection, except that the signal heads may be mounted if the faces are covered with a black opaque material.

The signal head covering material shall be of sufficient size to entirely cover the display. The covering shall extend over all edges of the signal housing and shall be securely fastened at the back.

Optically Programmed Signal Head:

The visibility zone of the optically programmed signal heads shall be set as directed by the Engineer.

Induction Loop Vehicle Detectors

Section 8-20.3(14)C is supplemented with the following:

Item 2 is deleted.

The last two sentences of Item 4 are deleted.

Item 11 is deleted.

Round Loops

Round loops shall be constructed in accordance with the following requirements:

1. Loop conductor and lead in cable shall conform to these Special Provisions.
2. Round sawcuts shall be 6 feet in diameter and shall be constructed using equipment designed for cutting round loops. The equipment shall use a concave, diamond-segmented blade. The sawcuts shall be normal to the pavement surface and shall be a minimum of 0.25 inches wide. The sawcut depth shall be a minimum of 2 5/8 inches and a maximum of 3 inches measured at any point along the perimeter, except on bridge decks. Other methods of constructing the round sawcut, such as anchoring a router or flat blade saw, will not be allowed.
3. The bottom of the sawcut shall be smooth. No edges created by differences in sawcut depths will be allowed.
4. All sawcut corners shall be rounded to a minimum 1.5 inch radius.
5. All sawcuts shall be cleaned with a 1000 psi high pressure washer as certified by the manufacturer's label on the machine or as measured by an in line pressure gauge. Wash water and slurry shall be vacuumed out and

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
the sawcut shall be blown dry with compressed air. Sawcutting shall be subject to the requirements set forth in Section 1-07.5(3) and the subsection **Fish And Wildlife and Ecology Regulations** of the Special Provision **LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC**.

6. Loops shall be installed after all grinding and prior to paving the final lift of asphalt.
7. The loop shall be constructed using four turns of conductor. The conductor shall be installed one turn on top of the previous turn. All turns shall be installed in a clockwise direction. The conductors shall be secured to prevent floating with 2 inch lengths of high temperature foam backer rod sized for a snug fit. The backer rod shall be spaced at 2 foot intervals around the perimeter of the sawcut and at corners.

Loop sealant shall be installed in two layers. The first layer shall be allowed to cool before the second layer is applied. Installation of the sealant shall completely encapsulate the loop conductors. A minimum of 1 inch of sealant shall be provided between the top of the conductors and the top of the sawcut. The twisted polypropylene rope noted in Standard Plan J-8a is not allowed.

Use of kerosene solvent is prohibited.

Existing Traffic Loops

The Contractor shall notify the Area Traffic Engineer through the Engineer a minimum of five working days in advance of pavement removal in the loop areas.

If the Engineer suspects that damage to any loop may have resulted or believes it possible that an existing loop is not operating adequately, the Engineer may order the Contractor to perform the field tests specified in Section 8-20.3(14)D. The test results shall be recorded and submitted to the Engineer. Loops which fail any of these tests shall be replaced.

If advance loops are replaced, they shall be installed immediately ahead of or behind the existing loops. The Contractor shall avoid cutting through the existing loop or lead-in.

If replacement loops are not operational within 48 hours, the Contractor shall install and maintain interim video detection at no additional cost to the WSDOT until the permanent loops are in place. The type of interim video detection furnished shall be approved by the Engineer prior to installation.

Test for Induction Loops and Lead-in Cable

Section 8-20.3(14)D is supplemented with the following:

An inductance level below 75 microhenries is considered a failure for a round loop.

Test A - The resistance shall not exceed values calculated using the given formula.

Resistance per 1000 ft of 14 AWG, $R = 3.26 \text{ ohms} / 1000 \text{ ft}$

$$R = \frac{3.26 \times \text{distance of lead-in cable (ft)}}{1000 \text{ ft.}}$$

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
Communication Cable Acceptance Testing

Communications cable acceptance testing shall be performed for each pair of conductors. Acceptance testing shall commence only after all communication cable is installed, and all splices have been completed, with the exception of the splices connecting the new cable to existing cable. If any test fails, repairs shall be made by the Contractor and the entire test series shall be repeated.

Three tests shall be performed on each cable installation. All tests shall be conducted in the presence of the Engineer. The Contractor shall provide the necessary test equipment, perform the tests, and document the results. When the tests are completed, whether successful or not, the test result documentation shall be provided to the Engineer. All tests shall be conducted on all pairs in the communication cable to each cable drop point. Seven calendar days notice shall be given by the Contractor prior to performing any of the tests.

For each arterial all testing shall be conducted from the same cable drop point.

Continuity Test:

The continuity test shall be made on each conductor as well as the cable shield. Each conductor and/or shield shall show a resistance of not more than 20 ohms per 1,000 feet of conductor. The resistance of each conductor shall be recorded.

Insulation Test:

The insulation test shall be measured on each insulated conductor with all other conductors in the cable (including cable shield) grounded. The measurement shall be made with a DC potential of not less than 60% and not more than 90% of the insulation rating for 1 minute. Insulation resistance shall exceed 5,000 megohm-miles. The insulation resistance of each conductor shall be recorded.

Frequency Response and Noise Test:

The frequency response and noise tests shall be performed on each pair of conductors. All tests shall be made using transmission test instruments designed especially for use on data circuits. Two such instruments are required; one for use at the designated testing location and the other for use at each cable drop location.

The test sets shall be subject to approval by the Engineer prior to the start of the tests.

The first test shall measure frequency response from the test location to each cable drop. A tone of 0 dBm shall be applied to the transmitting end and the signal level shall be measured at the receiving end. The cable pair being tested shall be isolated from ground and terminated in 600 ohms at both test locations. A 10,000 ohm resistor shall terminate the same pair at all other cable drop locations. The test shall be performed at frequencies of 300, 500, 700, 1,004, 1,500, 2,300 and 3,000 Hz. The received tone shall be:

Greater than minus 16 dBm at 1,004 Hz.

2 dB gain to 8 dB loss with respect to the level at 1,004 Hz over the frequency range of 500 to 2,500 Hz.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
2 dB gain to 12 dB loss with respect to the level at 1,004 Hz over the frequency ranges of 300 to 500 Hz and 2,500 to 3,000 Hz.

The second test shall measure circuit or background noise. The cable pair being tested shall be terminated the same as in the previous test. A C-message filter in the test set shall restrict the spectrum to the range normally used for voice-grade data circuits. The noise level shall be at least 13 dB below the lowest signal level measured in the first test.

All test data shall be recorded in an approved format. Cables which fail the tests shall be repaired or replaced as directed by the Engineer.

8-25, GLARE SCREEN

Description

Section 8-25.1 is supplemented with the following:

This work shall consist of furnishing and constructing permanent and temporary barrier glare screen on concrete barrier in accordance with the Plans, these Specifications, and as directed by the Engineer.

Materials

Section 8-25.2 is supplemented with the following:

Barrier Glare Screen

Barrier glare screen shall consist of modular units with vertical blades mounted on a horizontal base rail. Base rails and blades shall be made of non-warping, non-metallic durable polymeric materials; shall be resistant to damage due to impacts, ultraviolet light, ozone, hydrocarbons, and other effects of atmosphere weathering; shall resist stiffening with age; and shall be designed for a minimum life equaling 60 months of outdoor service.

The color of blades shall be gray or green. Only one color shall be used throughout the project. The height of the blade shall be 24 inches. The blade width and spacing shall provide for a minimum 22 degree sight cutoff angle. The length of the unit shall be the same as the length of the concrete barrier that the unit is mounted on. The unit can be composed of smaller sub-units as long as the completed assembly is the same length as the concrete barrier. The unit shall not exceed 4.5 pounds per linear foot.

Brackets and mounting hardware may be metallic or non-metallic. Metallic brackets and anchor hardware shall be stainless steel or galvanized in accordance with ASTM A-153. Anchors shall be a stud mechanical system and shall include the necessary washers. The blade to rail base separation strength shall be a minimum of 1,500 pounds. Anchors shall have a minimum 3,000 pound pull-out and shear strength.

Barrier glare screen shall be selected from approved materials listed in the Qualified Products List.

Laboratory Tests

Three blades shall be cycled at 1000 hours in a weatherometer in accordance with ASTM G 53 (3 hr. 60C UV, 3 hr. 50C CON). The blades shall show no signs of delamination, distress, or discoloration. Physical properties of tensile strength and rigidity shall be maintained within 80 percent of the unconditioned values.

An impact test shall be performed on three partial sections of the modular unit consisting of the base rail and one blade. The temperature shall be 45 F. The modular unit shall be fastened in a similar fashion as to how the system would be used in the field. Each blade shall receive three impacts with a horizontal steel bar traveling at 50 MPH impacting at mid-height on the blade. After impact, the screening unit (blades and base) shall be inspected for the following criteria:

1. Any cracking, splitting, or delamination, other than surface cracking evident on only one face of the blade, is considered a failure.
2. If the blade leans more than 10 degrees from the vertical it is considered a failure.
3. Any separation of the blade from the base is considered a failure.
4. Any separation of the base from the attachment is considered a failure.

If an individual blade or base fails any of the above criteria, the product is unacceptable.

Pre-approval

In order for a particular model of temporary barrier glare screen to become pre-approved, the following conditions must be met:

1. The manufacturer must submit a written request for pre-approval along with samples for each model to be tested to: Materials Engineer, Department of Transportation Material Laboratory, P.O. Box 47365, Olympia, WA 98504-7365. Samples shall be complete with blades, base rail, and mounting hardware and shall be accompanied by the manufacture's written installation procedures.
2. The barrier screen will be field impact tested by the State Materials Laboratory to verify compliance with these specifications.
3. In lieu of State Materials Laboratory testing, the Lab will accept the results of pre-approved testing performed by the manufacturer or other agencies under the following conditions:
 - a. The State Materials Laboratory is informed of the pre-approval testing sufficiently in advance in order to attend and observe. Attendance will be at the discretion of the Materials Laboratory.
 - b. The results of the testing shall be reported in sufficient detail to enable the State Materials Laboratory to evaluate compliance with these specifications.

The Manufacturer must submit a certified test report, including test data developed by an approved testing laboratory, which demonstrates that the barrier screening complies with the requirements of the specifications. Certified test data supplied by

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
the manufacturer shall be subject to verification by appropriate tests conducted by the
State Materials Laboratory.

Frequency of field testing, evaluation, and pre-approval updating shall be at the sole
discretion of the Materials Laboratory.

Construction Requirements

Section 8-25.3 is supplemented with the following:

Barrier Glare Screen

The vertical blades shall be attached to the rail base in a positive mechanical manner to prevent unintentional blade rotation or dislocation. Barrier glare screen shall be attached to the top of the barrier using approved anchors and following the manufacturer's recommendations. Each modular unit of 10 feet or less shall be secured to the concrete barrier with anchors at a minimum of three points. Modular units greater than 10 feet in length shall be secured at a minimum of four points. Spanning the joint between concrete barrier sections will not be allowed.

When the temporary screening is no longer required, the Contractor shall remove the screening units. When noted in the contract that the screening will become the property of the Contracting Agency, the Contractor shall deliver and stockpile the screening units at the location noted in the contract.

DIVISION 9 - MATERIALS

9-03, AGGREGATES

HMA Tolerances and Adjustments

The last two sentences of item 1 in Section 9-03.8(7) are revised to read:

For VMA and VFA, the tolerance limits only apply to HMA accepted by statistical evaluation. The tolerance limits for VMA are applicable to mix design verification, acceptance of the test section and acceptance of the HMA; the tolerance limits for VFA are only applicable to mix design verification and acceptance of the test section. The tolerances for Va apply as follows: for HMA accepted by statistical evaluation, the tolerance limits for Va apply to mix design verification, acceptance of the test section and acceptance of the HMA; and for HMA accepted by nonstatistical evaluation and commercial evaluation, the tolerance limits for Va only apply to mix design verification.

9-29, ILLUMINATION, SIGNALS, ELECTRICAL

Conduit

Section 9-29.1 is supplemented with the following:

Conduit Expansion and/or Deflection Fitting

Expansion fittings, deflection fittings, and expansion/deflection fittings shall be from the Qualified Products List.

Junction Boxes

Section 9-29.2 is supplemented with the following:

NEMA Stainless Steel Junction Boxes

NEMA stainless steel junction boxes and cover screws shall conform to ASTM A 304. Junction boxes installed on exterior of structures shall have an external hinge. Junction boxes shall be labeled with the appropriate designation. See Standard Plans for traffic signal system and illumination system labeling. Communication system boxes shall be labeled in the same manner, with the exception that the label shall be COMM.

Polyethylene drain tubes for junction boxes mounted in structures shall be 3/8 inch diameter with a wall thickness of 0.62 inch and shall be rated for a 110 psi working pressure at 73° F.

Surface mounted junction boxes and junction boxes placed in cast in place structures shall be NEMA 4X.

Junction boxes installed in structures constructed by slip forming shall be NEMA 3X and shall be adjustable for depth, with depth adjustment bolts, which are accessible from the front face of the junction box with the lid installed.

Type 4, 5 and 6 Junction Boxes

Type 4, 5 and 6 junction boxes shall meet the following requirements:

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

Concrete shall have a minimum compressive strength of 4000 psi. The steel frame and lid shall be painted with a shop applied, inorganic zinc primer in accordance with Section 6-07.3.

Material for traffic bearing junction boxes shall conform to the following:

Concrete	Section 6-02
Reinforcing Steel	Section 9-07
Lid	ASTM A786 diamond plate rolled from plate Complying with ASTM A572M, Grade 50 or ASTM A588, both with min. CVN toughness of 20 ft-lb at 40F.
Frame and Stiffener Plates	ASTM A572, Grade 50 or ASTM A588, both with min. CVN toughness of 20 ft-lb at 40F.
Handle	ASTM A36 steel
Anchors (studs)	Section 9-06.15
Bolts, Nuts, Washers	ASTM F593 or A193, type 304 or 316

The lid stiffener plates shall bear on the frame. Mill so that there is full even contact, around the perimeter, between the bearing seat and lid stiffener plates, after fabrication of the frame and lid. The bearing seat and lid perimeter bar shall be free from loose mill scale, burrs, dirt and other foreign debris that would prevent solid seating. Bolts and nuts shall be liberally coated with anti-seize compound. Bolts shall be installed snug tight. The bearing seat and lid perimeter bar shall be machined to allow a minimum of 75% of the bearing areas to be seated with a tolerance of 0.0 to 0.005 inches measured with a feeler gage. The bearing area percentage will be measured for each side of the lid as it bears on the frame.

Type 4, 5 and 6 junction boxes and lids shall have a vertical load strength of 46,000 pounds without permanent deformation and 60,000 pounds without failure.

For each type of junction box (type 4, 5 and 6) to be installed, the Contractor shall provide a certified test report, prepared by an independent testing lab, which documents results of testing done by the independent testing lab for the manufacturer. The test report shall certify that the boxes meet or exceed the loading requirements and shall document the results of the load test listed below. The independent testing lab shall be approved by the State Materials Engineer and shall be located within the State of Washington. Representatives of the State Materials Lab shall witness the test and sign the test report. The Contractor shall give the Engineer 30 days notice prior to testing. Three copies of the test report shall be provided to the Engineer prior to acceptance.

Boxes shall be load tested to 46,000 pounds and then to 60,000 pounds. The test load shall be applied in both longitudinal and transverse orientations. At each interval the test box shall be inspected for lid deformation, failure of the lid/frame welds, vertical and horizontal displacement of the lid frame, cracks, and concrete spalling. The test load shall be applied uniformly through a 10 inch X 20 inch X 1 inch steel plate centered on the frame.

Junction boxes meeting the 46,000 pound requirement shall not exhibit any of the following deficiencies:

1. Permanent deformation of the lid or any impairment to the function of the lid.
2. Vertical or horizontal displacement of the lid frame.
3. Cracks wider than 0.012 inch that extend 12 inches or more.
4. Fracture or cracks passing through the entire thickness of the concrete.
5. Spalling of the concrete.

Junction boxes meeting the 60,000 pound requirement shall exhibit the following:

1. The lid is operational.
2. The lid is securely fastened.
3. The welds have not failed.
4. Permanent dishing or deformation of the lid is 1/4 inch or less.
5. No buckling or collapse of the box.

Conductors, Cable

In Section 9-29.3, Item 7 is revised to read as follows:

7. Two conductor shielded (2CS) cable shall have 14 AWG (minimum) conductors and shall conform to I.M.S.A. specification No. 50-2.

In Section 9-29.3, Item 8 is revised to read as follows:

8. Detector loops shall use 14 AWG stranded copper conductors, and shall conform to IMSA Specification 51-7, with cross-linked polyethylene (XLPE) insulation encased in a polyethylene outer jacket (PE tube).

Section 9-29.3 is supplemented with the following:

Communication Cable

Communication cable shall be as specified in Section 9-29.3 Item 11, except it shall be 22 gauge, and the number of cable pairs shall be as shown in the Plans.

Aerial communication cable shall meet REA specification PE-38 and shall be 22 gauge. The number of cable pairs shall be as shown in the Plans.

Section 9-29.6(1), including the heading, is revised to read:

Steel Light and Signal Standards

Steel plates and shapes for light and signal standards shall conform to the requirements of ASTM A 36. Shafts for light and signal standards, except Type PPB signal standards, shall conform to ASTM A 572, Grade 50. Shafts and caps for Type PPB signal standards, slipfitters for type PS, I, FB, and RM signal standards, and all pipes shall conform to ASTM A 53, Grade B. Base plates for light standards shall conform to ASTM A 572, Grade 50, except as otherwise noted in the Standard plans for fixed base light standards. Base plates for signal standards shall conform to ASTM A 36. Connecting bolts shall conform to AASHTO M 164. Fasteners for handhole covers, bands on lighting brackets, and conductor attachment brackets shall conform to ASTM F 593.

Light and signal standards shall be hot-dipped galvanized in accordance with AASHTO M 111 and AASHTO M 232. Galvanized steel light and signal standards shall not be painted.

Section 9-29.6(1)A is deleted.

Transformers

Section 9-29.9 is supplemented with the following:

Transformers shall be 480/120 volt, single phase, indoor/outdoor type dry transformers rated as indicated in the Plans.

The transformer coils, buss bar, and all connections shall be copper.

Transformers rated 7.5 kva and above shall be fitted with taps to provide voltages that are 5% and 10% below normal full capacity.

Luminaires

Section 9-29.10 is supplemented with the following:

Conventional highway luminaires shall be high-pressure sodium Type III medium cut-off.

The refractor or flat lens shall be mounted in a doorframe assembly, which shall be hinged to the luminaire and secured in the closed position to the luminaire by means of an automatic latch. The refractor or flat lens and doorframe assembly, when closed, shall exert pressure against a gasket seat. Gaskets shall be composed of material capable of withstanding temperatures involved and shall be securely held in place.

Sections 9-29.10(2), 9-29.10(3), and 9-29.10(4) are deleted.

Electrical Splice Materials

Aerial Splice Enclosures

Aerial splice enclosures shall meet the requirements of REA specification PE-52 and GTE Automatic Electric Specification GTS-8514. Aerial splice enclosures shall be re-enterable and resealable without requiring special tools or equipment. Conductor connections shall be sealed, moisture resistant telephone type connectors approved for outside use. The cable shields shall be bonded using an approved low resistance shield connector.

Illumination Circuit Splices

Section 9-29.12(1) is supplemented with the following:

Temporary splices shall be the heat shrink type.

Traffic Signal Splice Material

Section 9-29.12(2) is revised to read:

Induction loop splices shall be either mastic type, or moisture resistant two way heat shrink type meeting SAE-AMS I-23053, or re-enterable type with semi-hardening epoxy filling compound that remains semi-flexible enclosed in a re-enterable rigid mold with end cap seals.

Traffic Signal Controllers

Emergency Preemption

Section 9-29.13(3) is supplemented with the following:

Emergency Preemption Logic - NEMA

The traffic signal controller shall have the capability of preempting normal traffic signal operation.

The cabinet shall be wired to complement the controller and the preemption hardware required in this contract.

The preemption logic shall be an internal software function of the traffic signal controller.

The preemption system shall function as follows:

When a preemption call is registered for the phase or phases the controller is presently serving, the controller shall remain in that phase until this call is dropped.

When a preemption call is registered while the controller is serving a vehicular or pedestrian phase other than the preemption phases called for, a clearance interval (for pedestrians and vehicles) shall immediately be timed. The controller shall then go to the emergency preemption phases being called for, skipping all other vehicular and pedestrian calls whether or not calls exist.

During any preemption phase, "Don't Walk" or "Hand Symbol" shall be displayed on all pedestrian heads.

Upon termination of preemption operation, the controller shall be allowed to sequence normally.

Preemption

The system shall be capable of preempting the controller to the phases shown in the Plans when a signal is received from the field detector.

Pre-emption equipment shall be either Opticom or Tomar.

Opticom

If Opticom pre-emption equipment is used, the Contractor shall furnish and install the following:

1. Pre-emption detectors shall be 3M Opticom Model 711.
2. Discriminators shall be four-channel model 454 units. One is required at each controller.

In addition, where auxiliary Opticom pre-emption is used, the Contractor shall furnish and install the following:

- 1 A 757 auxiliary optical detector wiring harness where more than one detector is called for per channel.
- 2 A twelve position terminal block of the barrier type rated for 20A at 600 volts RMS minimum and meeting the requirements of Chapter 11 of the

Tomar

Tomar equipment is allowed provided that it is able to receive and respond to Opticom emitter signals.

If Tomar equipment is used, the Contractor shall furnish and install the following:

- 1 Pre-emption detectors shall be Tomar Model 2090-SD complete with mount and mounting hardware.
- 2 Discriminators shall be Tomar Model 2080 four-channel units. One is required per controller.
- 3 The Contractor shall make all initial range adjustments.
- 4 The pre-emption function operation tests shall be performed using an Opticom emitter.

Radio Interference Suppressers

Section 9-29.13(6) is supplemented with the following:

The interference filters shall be hermetically sealed in a substantial metal case filled with a suitable insulating compound.

Emergency Preemption Hardware

Emergency preemption hardware equipment installed by this contract shall activate the Emergency Preemption Logic in the traffic signal controller when a signal is received from a dry contact closure.

The contact closure shall be activated by a 120-volt input that is isolated from all controller circuitry.

The equipment used to provide the contact closure shall be housed in a separate enclosure located within the controller cabinet.

Traffic-Actuated Controllers

Section 9-29.13(7) is supplemented with the following:

Type 170 traffic signal control equipment to be provided shall meet the requirements given in this section and the California DOT Type 170 control system hardware specification as currently amended.

The controller shall be a Model 170E or Model HC11-170E. The controller shall be a quad ACIA unit.

PROM modules installed in Master controllers shall be model 412B2 or Safetran 412C configured for use with the associated Wapiti W70SM software.

PROM modules installed in local controllers shall be model 412C and shall be configured using Method 2 and Memory Select Option 4. The memory and device mapping shall be as follows:

Chip Position	U1	U2	U3	U4
Address Range	8000-FFFF	3000-4FFF	7010-7FFF	1000-2FFF

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
(HEX)

Device 27256 Dallas 1225 Dallas 1225 6264*

*Battery backup jumpering installed.

"CI" INPUT/OUTPUT FUNCTION ASSIGNMENTS

PROGRAM WAPITI W4IKS

PIN	I/O	Function	PIN	I/O	Function
1	****	logic ground	53	I2-7	ADV. ENABLE
2	01-1	4P DONT WALK	54	I2-8	
3	01-2	4P WALK	55	I3-1	5 EXTENSION & COUNT
4	01-3	4 RED	56	I3-2	1 EXTENSION & COUNT
5	01-4	4 YELLOW	57	I3-3	7 EXTENSION & COUNT
6	01-5	4 GREEN	58	I3-4	3 EXTENSION & COUNT
7	01-6	3 RED	59	I3-5	5 EXTENSION & COUNT
8	01-7	3 YELLOW	60	I3-6	1 EXTENSION & COUNT
9	01-8	3 GREEN	61	I3-7	7 EXTENSION & COUNT
10	02-1	2P DONT WALK	62	I3-8	3 EXTENSION & COUNT
11	02-2	2P WALK	63	I4-5	2 EXTENSION & COUNT
12	02-3	2 RED	64	I4-6	6 EXTENSION & COUNT
13	02-4	2 YELLOW	65	I4-7	4 EXTENSION & COUNT
14	* *	logic ground	66	I4-8	8 EXTENSION & COUNT
15	02-5	2 GREEN	67	I5-1	2 PEDESTRIAN PB
16	02-6	1 RED	68	I5-2	6 PEDESTRIAN PB
17	02-7	1 YELLOW	69	I5-3	4 PEDESTRIAN PB
18	02-8	1 GREEN	70	I5-4	8 PEDESTRIAN PB
19	03-1	8P DONT WALK	71	I5-5	EVA PREEMPT
20	03-2	8P WALK	72	I5-6	EV B PREEMPT
21	03-3	8 RED	73	I5-7	EVC PREEMPT
22	03-4	8 YELLOW	74	I5-8	EVD PREEMPT
23	03-5	8 GREEN	75	I6-1	
24	03-6	7 RED	76	I6-2	2 EXTENSION
25	03-7	7 YELLOW	77	I6-3	6 EXTENSION
26	03-8	7 GREEN	78	I6-4	4 EXTENSION
27	04-1	6P DONT WALK	79	I6-5	8 EXTENSION
28	04-2	6P WALK	80	I6-6	ADVANCE
29	04-3	6 RED	81	I6-7	FLASH SENSE
30	04-4	6 YELLOW	82	I6-8	STOP TIME
31	04-5	6 GREEN	83	06-1	3P DON'T WALK*
32	04-6	5 RED	84	06-2	3P WALK*
33	04-7	5 YELLOW	85	06-3	OLD RED*
34	04-8	5 GREEN	86	06-4	OLD YELLOW*
35	05-1	(A) TOD/DOW - OUTPUT	87	06-5	OLD GREEN*
36	05-2	(B) TOD/DOW - OUTPUT	88	06-6	OLC RED*
37	05-3	(C) TOD/DOW - OUTPUT	89	06-7	OLC YELLOW*
38	05-4	(D) TOD/DOW - OUTPUT	90	06-8	OLC GREEN*
39	I1-1	2 EXTENSION & COUNT	91	07-1	1 DON'T WALK*
40	I1-2	6 EXTENSION & COUNT	92	* *	logic ground*
41	I1-3	4 EXTENSION & COUNT	93	07-2	IP WALK*
42	I1-4	8 EXTENSION & COUNT	94	07-3	OLB RED*
43	I1-5	2 EXTENSION & COUNT	95	07-4	OLB YELLOW*
44	I1-6	6 EXTENSION & COUNT	96	07-5	OLB GREEN*
45	I1-7	4 EXTENSION & COUNT	97	07-6	OLA RED*

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

46	I1-8	8 EXTENSION & COUNT	98	07-7	OLA YELLOW*
47	I2-1	2 CALL DETECTOR	99	07-8	OLA GREEN*
48	I2-2	6 CALL DETECTOR	100	05-8	
49	I2-3	4 CALL DETECTOR	101	05-6	
50	I2-4	8 CALL DETECTOR	102	05-7	FLASH OUTPUT
51	I2-5	RR1 (PED INHIBIT)	103	05-8	WATCHDOG
52	I2-6	RR2 (RAILROAD) 104	* *		logic ground

Environmental, Performance, and Test Standards for Solid-State Traffic Controllers

Section 9-29.13(7)A is supplemented with the following:

The scope of this specification includes the controller assembly of solid-state design installed in a weatherproof controller cabinet.

Flashing Beacon Control

Section 9-29.15 is supplemented with the following:

Solid State Flasher

The solid state flasher shall provide two output circuits to permit alternate flashing of signal faces. The flash rate shall be 55 flashes per minute $\pm 10\%$. Duty cycle for each circuit shall be 50% on, 50% off $\pm 2\%$.

Each circuit shall be rated at 15 amperes and switching shall occur at the zero crossover point of the AC voltage. The voltage range shall be 95 to 135 volts AC. The nominal voltage shall be 120 volts AC. The operating frequency range shall be 60 Hz ± 3.0 Hz. The two-circuit solid-state flasher shall be designed to operate as specified at any ambient temperature range from -30°F. to +165°F. (-34.4°C. to +73.8°C).

Cabinet

The raintight housing shall be aluminum, conforming to the requirements of Section 9-29.25 and this Special Provision. Cabinet dimensions shall be:

<u>Depth</u>	<u>Height</u>	<u>Width</u>
6 inches	10 inches	8 inches

The cabinet door shall be hinged and secured with a spring-loaded construction core lock capable of accepting a Best CX series core to be installed by others. Socket bases for the flasher unit shall be mounted on a circuit board inside the cabinet.

Vehicular Signal Heads

Section 9-29.16 is supplemented with the following:

Covering Material

Signal head covering material shall consist of 4 mil minimum thickness black polyethylene sheeting.

Backplates

Backplates shall be constructed of vented flat black anodized aluminum and shall be mounted with stainless steel hardware.

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
Optical Units

Section 9-29.16(2)A is supplemented with the following:

All traffic signal displays shall be the Light Emitting Diode (LED) type and shall be from one of the following manufacturers:

Dialight Corporation
1913 Atlantic Avenue
Manasquan, NJ 08736
Telephone: (732) 223-9400
Fax: (732) 223-8788

GELcore, LLC
6810 Halle Drive
Valley View, OH 44125
Telephone: (216) 606-6555
Fax: (216) 606-6556

Precision Solar Controls, Inc.
2960 Market Street
Garland, TX 75041
Telephone: (972) 278-0553
Fax: (972) 271-9583

Each LED signal module shall be designed to be installed in the door frame of a standard traffic signal housing. The lamp socket, reflector holder and lens used with an incandescent lamp shall not be used in a signal section in which a LED signal module is installed. The installation of an LED signal module shall not require any modification to the housing. The LED signal module shall be a single, self-contained device, not requiring onsite assembly for installation into an existing traffic signal housing.

All red and yellow LED signal modules shall be manufactured with a matrix of AlInGaP LED light sources and green LED signal modules shall be manufactured with a matrix of InGaN LED light sources. The LED traffic signal module shall be operationally compatible with controllers and conflict monitors on this project. The LED lamp unit shall contain a disconnect that will show an open switch to the conflict monitor when less than 60% of the LEDs in the unit are operational.

Each LED module shall conform to the current standards in Institute of Transportation Engineers (ITE) VTC SH Part 2 and a Certificate of Compliance with these standards shall be submitted by the manufacturer for each type of signal head. The certificate shall state that the lot of signal heads meets the current ITE specification. A label shall be placed on each LED signal module certifying conformance to this specification. The manufacturer's name, trademark, serial number and other necessary identification shall be permanently marked on the

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
backside of the LED signal module. LED signal modules used on this project shall be from the same manufacturer. A label shall be provided on the LED housing and the Contractor shall mark the label with a permanent marker to note the installation date.

The manufacturer shall provide a written warranty against defects in materials and workmanship for the LED signal modules for a period of 60 months after the installation of the modules. All warranty documentation shall be given to the Engineer prior to installation.

Signal Head Mounting Brackets and Fittings

Section 9-29.17 is supplemented with the following:

The Type M mounting bracket shall be a bronze plumbizer.

Vehicle Detector

Section 9-29.18 is supplemented with the following:

Amplifiers shall be capable of generating a continuous output to the controller when a loop or lead-in failure occurs.

Loop sealant for use in ACP pavement shall be one of the following:

1. RAI Pro-Seal 6006EX
2. QCM EAS-14
3. 3M Black 5000

Loop sealant for use on concrete bridge decks and PCC pavement shall be one of the following:

1. 3M Black 5000
2. Gold Label Flex 1P
3. QCM EAS-14

Installation shall conform to the manufacturer's recommendations.

Pedestrian Push Buttons

Section 9-29.19 is supplemented with the following:

The assembly shall be constructed so that it will be impossible to receive an electrical shock under any weather conditions.

Pedestrian Signals

Section 9-29.20 is supplemented with the following:

Audible Pedestrian Indicators

Audible pedestrian indicators shall meet the requirements of the American Disability Act. Installation shall be done in conformance with procedures specified by the manufacturer and approved by the Engineer.

Output shall be adjustable to provide a "Cuckoo" indication for north south movements or a "Peep-Peep" indication for east west movements. The indicators shall be self switching to one of two adjustable output levels depending on ambient noise conditions.

Indicators shall be olive green.

Indicators shall mount on top of pedestrian signals with a flex mount which can be used to aim the indicator. The mounting hardware shall incorporate an O ring and shall prevent entrance of moisture into the pedestrian signal.

Indicators shall function when wired to the walk terminal and to the AC neutral terminal of the associated pedestrian signal.

LED Pedestrian Signal Modules

All pedestrian signal displays shall be the Light Emitting Diode (LED) type. Each LED pedestrian signal module shall be designed as retrofit replacements for optical units in a standard pedestrian signal housing and shall not require special tools for installation. The installation of an LED pedestrian module shall not require any modification to the housing. Each LED pedestrian module shall be a single, self-contained device, not requiring any on-site assembly for installation into any pedestrian signal housing. The power supply for the LED pedestrian module may be packaged as a separate module.

All pedestrian “HAND” modules shall be Portland Orange and shall conform to current ITE standards for size, chromaticity and intensity. LED pedestrian “HAND” modules shall be manufactured with a matrix of AlInGaP LED light sources. All pedestrian walking “MAN” modules shall be Lunar White and shall conform to current ITE standards for size, chromaticity and intensity. LED pedestrian walking “MAN” modules shall be manufactured with a matrix of InGaP LED light sources. The “HAND” and walking “MAN” message bearing surfaces shall be filled, not outline, symbols. The LED pedestrian modules shall be operationally compatible with controllers and conflict monitors on this project.

The LED pedestrian module shall be rated for use in the ambient operating temperature range of -40°F to 165°F. Each LED pedestrian module shall be protected against dust and moisture intrusion per the NEMA Moisture Resistant STD 250-1991 for Type 4 enclosures to protect all internal components. The assembly, manufacturing, and mounting of the LED pedestrian module shall be designed to assure all internal LED and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources. The manufacturer's name, trademark, serial number and other necessary identification shall be permanently marked on the backside of the LED pedestrian module. LED signal pedestrian modules used on this project shall be from the same manufacturer. A label shall be provided on the LED housing and the Contractor shall mark the label with a permanent marker to note the installation date.

LED pedestrian modules shall operate at a maximum power consumption of 15W. Each LED pedestrian module shall operate from a 60 ± 3 Hz AC line over a range of 80VAC to 135VAC. Nominal operating voltage for all measurements shall be 120 ± 3 volts rms. The LED circuitry shall prevent flicker at less than 100 Hz over the voltage range specified above. Fluctuations in the line voltage specified above shall not affect luminous intensity by more than $\pm 10\%$. The signal module on-board circuitry shall include voltage surge protection to withstand high-repetition noise transients and low-repetition high-energy transients as stated in Section 2.1.6, NEMA Standard TS-2, 1992. The individual LED light sources shall be wired so that catastrophic failure of any one LED light source will result in the loss of not more than 20% of the signal module light sources. LED pedestrian signal modules shall provide a power factor of 0.90 or greater when operated at nominal operating voltage, and 77°C. Total harmonic distortion induced into an AC power line by an LED

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build pedestrian module shall not exceed 20%. Each LED pedestrian module and associated onboard circuitry shall meet Federal Communications Commission (FCC) Title 47, SubPartB, Section 15 regulations concerning the emission of electrical noise. Two secured, color coded, 600V, 20AWG minimum, jacketed wires, conforming to the National Electrical Code, rated for service at 221°C, are to be provided for electrical connection.

The manufacturer shall provide a written warranty against defects in materials and workmanship for the LED signal modules for a period of 60 months and against loss of intensity below 50% of original values for a period of 36 months after installation of the modules. All warranty documentation shall be given to the Engineer prior to installation.

Service Cabinets

Section 9-29.24 is supplemented with the following:

Service cabinets shall be fabricated from 0.125 inch sheet aluminum (5052 alloy) with mill finish. The aluminum shall not be anodized and the exterior shall not be painted.

Service cabinets shall have ventilation louvers on the lower sides complete with screens and filters.

A spring-loaded construction core lock capable of accepting a Best CX series core installed by others shall be installed on all doors accessing WSDOT equipment.

The main cabinet door shall include a two-position door stop assembly and shall have a three point latch.

A three-position terminal block shall be installed between the main electrical service panel and the photo cell assembly base.

The cabinet bonding connection shall be a welded plate with stainless steel hardware, Belleville washers, cu/al lug, and antioxidant compound. The bolt shall be torqued to fully compress the Belleville washers.

Steel conduit penetrating the cabinet shall have a grounding bushing and shall be bonded to the system ground.

Amplifier, Transformer, and Terminal Cabinets

Section 9-29.25 is supplemented with the following:

Cabinets shall be fabricated from 0.125-inch sheet aluminum (5052 alloy) with mill finish. Cabinets shall not be anodized and the exterior shall not be painted.

Section 9-29 is supplemented with the following:

Underdeck Cutoff Fixture

Underdeck fixtures shall be wall mountable and shall be hose-down rated with a gasket between the doorframe and ballast housings and between the doorframe and lens. Housing shall be low copper alloy cast aluminum with gray paint finish. The luminaires down light efficiency shall be no less than 64% of lamp output, with peak candle power occurring at 65 to 70 degrees, using a heavy borosilicate prismatic glass lens with 180 degree beam spread. Lamps shall have HPF ballasts, per requirements of Section 9-29.9. Lamps shall be high-pressure sodium, with mogul base socket. Lens shall be vandal resistant. The luminaires shall have wire

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build
protective guards on the lenses. Fusing shall be provided for all conductors above
ground potential.

Mercury Vapor Lamps

Mercury vapor lamps for this project shall have a 24,000 hour rated life. When the lamps are placed in luminaires, the support framework of the arc tube shall be in a vertical plane.

High-Pressure Sodium Vapor Lamps

High-pressure sodium vapor lamps for this project shall have a 24,000 hour rated life.

STANDARD PLANS

The State of Washington Standard Plans for Road, Bridge and Municipal Construction M21-01 (English) transmitted under Publications Transmittal No. PT 04-040, effective August 2, 2004 is made a part of this contract.

The Standard Plans are revised as follows:

C-11b Sheets 1 and 2

In the PRECAST FOOTING, ELEVATION view (Sheet 1) and in the CAST-IN-PLACE FOOTING, ELEVATION view (Sheet 2), COMMERCIAL CONCRETE is revised to CONCRETE CLASS 4000.

C-14f

In SECTION "A", the reference to SEE STD. PLAN C-14b is revised to SEE STD. PLAN C-14e.

C-14g

In SECTION "A" and SECTION "B", the reference to SEE STD. PLAN C-14b is revised to SEE STD. PLAN C-14e.

G-8a

The notes under the HINGE CONNECTION DETAIL are revised to read:

Hinge Connection Bolts shall be tightened ½ turn past snug tight.

The hinge plate shall be of the size and type as provided by TransPo Industries.

K-1 through K-27

These plans shall not be used on projects administered by WSDOT.

The following are the Standard Plan numbers applicable at the time this project was advertised. The date shown with each plan is the publication approval date shown in the lower right-hand corner of that plan. Standard Plans not having this date shall not be used in this contract.

A-1.....5/13/02	A-3.....5/30/02	A-5.....2/24/03
A-2.....5/09/02	A-4.....3/07/97	A-6.....2/24/03
B-1.....7/21/03	B-4g.....7/18/97	B-20d.....6/30/04
B-1a.....6/23/04	B-4h.....5/09/97	B-21.....7/18/97
B-1b.....6/23/04	B-7.....5/09/97	B-21a.....8/10/98
B-1e.....5/20/04	B-7a.....6/17/02	B-22.....7/21/03
B-1z.....6/23/04	B-8.....6/23/04	B-22a.....8/01/97
B-2.....6/17/02	B-8a.....6/23/04	B-23a.....5/09/97
B-2a.....6/17/02	B-9.....5/09/97	B-23b.....5/09/97
B-2b.....6/17/02	B-9a.....5/09/97	B-23c.....5/20/04
B-2c.....6/17/02	B-9b.....5/09/97	B-23d.....5/09/97
B-2d.....6/17/02	B-9c.....7/18/97	B-25.....6/30/04
B-2e.....2/25/04	B-9d.....7/18/97	B-26.....7/18/97
B-3.....1/28/02	B-11.....7/31/01	B-27.....8/01/97

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

B-3a.....	5/09/97	B-13.....	12/04/98	B-28.....	10/06/99
B-4b.....	5/09/97	B-18.....	5/09/97	B-29.....	4/24/98
B-4c.....	5/09/97	B-18a.....	5/09/97	B-30.....	8/10/98
B-4d.....	9/16/02	B-18b.....	7/18/97		
B-4f.....	5/09/97	B-19.....	5/30/97		
C-1.....	10/31/03	C-3a.....	10/31/03	C-8e.....	6/24/02
C-1a.....	7/31/98	C-3b.....	10/31/03	C-8f.....	6/30/04
C-1b.....	10/31/03	C-3c.....	10/31/03	C-10.....	7/31/98
C-1c.....	5/30/97	C-4.....	7/13/01	C-11.....	5/20/04
C-1d.....	10/31/03	C-4a.....	7/13/01	C-11a.....	5/20/04
C-2.....	1/06/00	C-4b.....	6/23/00	C-11b.....	5/20/04
C-2a.....	7/17/98	C-4e.....	2/20/03	C-12.....	7/27/01
C-2b.....	6/12/98	C-4f.....	6/30/04	C-13.....	4/16/99
C-2c.....	2/20/03	C-5.....	10/31/03	C-13a.....	4/16/99
C-2d.....	5/22/98	C-6.....	5/30/97	C-13b.....	4/16/99
C-2e.....	3/07/97	C-6a.....	3/14/97	C-14a.....	7/26/02
C-2f.....	3/14/97	C-6c.....	1/06/00	C-14b.....	7/26/02
C-2g.....	7/27/01	C-6d.....	5/30/97	C-14c.....	7/26/02
C-2h.....	3/28/97	C-6f.....	7/25/97	C-14d.....	7/26/02
C-2i.....	3/28/97	C-7.....	10/31/03	C-14e.....	7/26/02
C-2j.....	6/12/98	C-7a.....	10/31/03	C-14f.....	7/26/02
C-2k.....	7/27/01	C-8.....	4/27/04	C-14g.....	10/31/03
C-2n.....	7/27/01	C-8a.....	7/25/97	C-14h.....	12/02/03
C-2o.....	7/13/01	C-8b.....	7/17/98	C-14i.....	12/02/03
C-2p.....	10/31/03	C-8c.....	5/30/97	C-14j.....	12/02/03
C-3.....	10/31/03	C-8d.....	5/20/04		
D-1a.....	1/23/02	D-2i.....	3/14/97	D-2w.....	3/07/97
D-1b.....	10/06/99	D-2j.....	3/14/97	D-2x.....	3/07/97
D-1c.....	10/06/99	D-2k.....	3/14/97	D-2y.....	9/12/97
D-1d.....	10/06/99	D-2l.....	3/14/97	D-3.....	6/30/04
D-1e.....	1/23/02	D-2m.....	3/14/97	D-3a.....	6/30/04
D-1f.....	10/06/99	D-2n.....	3/14/97	D-3b.....	6/30/04
D-2a.....	3/14/97	D-2o.....	3/14/97	D-3c.....	6/30/04
D-2b.....	3/14/97	D-2p.....	3/14/97	D-4.....	12/11/98
D-2c.....	3/14/97	D-2q.....	3/14/97	D-6.....	6/19/98
D-2d.....	3/14/97	D-2r.....	3/14/97	D-7.....	10/06/99
D-2e.....	3/14/97	D-2s.....	3/14/97	D-7a.....	10/06/99
D-2f.....	3/14/97	D-2t.....	3/14/97	D-9.....	12/11/98
D-2g.....	3/14/97	D-2u.....	3/07/97		
D-2h.....	3/14/97	D-2v.....	3/07/97		
E-1.....	7/25/97	E-4.....	8/27/03	E-5.....	5/29/98
E-2.....	5/29/98	E-4a.....	8/27/03		
F-1.....	12/17/02	F-2c.....	6/23/04	F-3c.....	1/13/03
F-1a.....	12/17/02	F-2d.....	6/23/04	F-3d.....	1/29/03
F-2.....	8/27/99	F-3.....	1/13/03	F-3e.....	1/13/03
F-2a.....	6/23/04	F-3a.....	1/29/03	F-4.....	1/13/03
F-2b.....	6/23/04	F-3b.....	1/13/03		

Washington State WSDOT of Transportation – Kirkland HOV Phase 1 –Design-Build

G-19/12/01	G-4b6/30/04	G-8b 6/04/02
G-26/04/02	G-68/27/03	G-8f..... 6/30/04
G-2a6/04/02	G-6a8/27/03	G-8g..... 6/30/04
G-36/04/02	G-6b8/27/03	G-9a..... 6/25/02
G-3a6/04/02	G-7 7/18/97	G-9b..... 4/02/99
G-4a5/20/04	G-8a 10/06/99	
H-1 1/10/02	H-4a..... 3/11/03	H-7 8/10/98
H-1a4/14/00	H-5..... 2/18/00	H-8 9/18/98
H-1b5/05/00	H-5a..... 2/18/00	H-9 4/18/97
H-1c..... 1/10/02	H-5b..... 2/18/00	H-10 5/29/98
H-1d 1/10/02	H-5c..... 6/24/02	H-12 5/09/02
H-1e4/14/00	H-5d..... 4/14/00	H-12b 2/25/04
H-25/29/02	H-5e..... 2/20/03	H-13 7/25/97
H-34/14/00	H-5f..... 6-23/04	H-13a 7/25/97
H-3a 6/23/00	H-5h..... 4/27/04	H-14 4/23/99
H-4 10/29/03	H-6..... 10/29/03	
I-17/18/97	I-6 7/17/03	I-11..... 9/11/03
I-24/23/99	I-7 7/17/03	I-12..... 7/17/03
I-38/20/99	I-8 7/17/03	I-13..... 7/17/03
I-47/17/03	I-9 7/17/03	I-14..... 7/17/03
I-57/17/03	I-10 7/17/03	
J-1b 10/08/99	J-5 8/01/97	J-8a..... 5/20/04
J-1c4/24/98	J-6c..... 4/24/98	J-8b..... 5/20/04
J-1e8/01/97	J-6f 4/24/98	J-8c..... 5/20/04
J-1f6/23/00	J-6g 12/12/02	J-8d..... 5/20/04
J-38/01/97	J-6h 4/24/98	J-9a..... 4/24/98
J-3b 11/05/03	J-7a 9/12/01	J-10..... 7/18/97
J-3c6/24/02	J-7c..... 6/19/98	J-11a..... 9/12/01
J-3d 11/05/03	J-7d 4/24/98	J-12..... 5/20/04
K-1..... 12/20/02	K-10 12/20/02	K-19 12/20/02
K-2..... 12/20/02	K-11 12/20/02	K-20 12/20/02
K-3..... 12/20/02	K-12 12/20/02	K-21 12/20/02
K-4..... 12/20/02	K-13 12/20/02	K-22 12/20/02
K-5..... 12/20/02	K-14 12/20/02	K-23 12/20/02
K-6..... 12/20/02	K-15 12/20/02	K-24 12/20/02
K-7..... 12/20/02	K-16 12/20/02	K-25 12/20/02
K-8..... 12/20/02	K-17 12/20/02	K-26 12/20/02
K-9..... 12/20/02	K-18 12/20/02	K-27 12/20/02
L-17/18/97	L-3 7/18/97	L-5a..... 7/31/98
L-27/18/97	L-5 7/31/98	L-6..... 7/25/97

